Electrical Review

THE PIONEER ELECTRICAL WEEKLY OF AMERICA

VOL. XLII. No. 14. NEW YORK, SATURDAY, APRIL 4, 1903. ISSUED WEEKLY

ELECTRICAL REVIEW

13 to 21 Park Row NEW YORK

BY THE

ELECTRICAL REVIEW PUBLISHING COMPANY

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TELEPHONE CALL (private branch exchange connecting all departments) — "21 Cortlandt."

REGISTERED CABLE ADDRESS — "Electview," New York.

SUBSCRIPTIONS

One Year, United States and Canada	$3.00
One Year, Foreign Countries	5.00
Single Copies, each	10
Copies supplied for only one year back, each	25

TO ADVERTISERS

CHANGES for advertisements should be in this office by Friday noon for the following week's issue.

NEW ADVERTISEMENTS should be in the office not later than Monday noon to assure publication in that week's issue.

THE DEADLY HORSE.

An English journal, devoted to the interests of automobiles, has been collecting recently statistics of horse accidents, to offset similar figures relating to automobile mishaps. The statistician in this case kept up his work for a period of 159 days, watching all the daily newspapers. During this time he noted 1,775 horse accidents, resulting in death to 225 people and injuries to 1,371 others. Although it would be unfair to the horse to compare these figures directly with automobile accidents happening during the same period, as no figures giving the number of horses in use are at hand, they do show that accidents will happen even in this old and well developed mode of travel, and this fact should be borne in mind by the ready critics who are continually crying out against the automobile as a menace to the safety of all who use the public highways.

AMERICAN AND BRITISH RAILWAY PRACTICE.

A report made recently by Lieutenant-Colonel H. A. Yorke to the British Board of Trade upon American and British railway practice has given rise to wide comment in the British technical papers. Colonel Yorke is the chief railway inspector of the board, and made a special visit to this country to investigate railway methods and apparatus in use here.

Report Favors British Practice.

We gather from our English exchange that the report gives a careful digest of the principal features of American railway practice, and points out the limitations which British conditions and considerations of safety impose upon their adoption. As a whole, the report is taken as a vindication of ordinary British railway methods. Thus, for instance, Colonel Yorke shows that the English method of laying rails, which involves the use of a chair spiked to the cross-tie, gives a bearing surface on the tie of 1,260 square inches to a thirty-foot rail, as against but 672 square inches for the American rail. Other advantages of English methods are claimed, but in some cases, where American practice seems better, a change is recommended if possible. A change from the short English freight car to the larger American type is not recommended because of the smaller spacing between tracks and the less head-room and clearance at stations and bridges in Great Britain. Furthermore figures are given, which are intended to show that the English cars have no more dead weight than those in use in this country.

Automatic Signaling.

The section of the report dealing with automatic signaling takes a discouraging view. In Colonel Yorke's opinion this is simply a labor-saving device which adds nothing to the safety of operation. The point is made against these systems that in this country they have not replaced the old block system, but have been installed merely as an additional signaling system, at considerable expense. Their use seems to be criticized more from the standpoint of the increased expense involved than from the thought of securing additional safety for passengers.

Electric Railways.

Electric railway methods in this country, however, have many valuable lessons for British railway officials. In England much restriction has been placed upon the trolley, which has retarded very materially its growth. Steam railway systems also have opposed the electric railway with a rather near-sighted policy. They dread the loss in local traffic and do not see the benefit which will accrue to them through main line traffic. This part of Colonel Yorke's report will, it is to be hoped, help along the electric railway interests of England very materially.

Report of Interest to American Engineers.

As to his criticism upon American steam railway practice, we shall say nothing; but sincere criticism is always beneficial to the criticized, and doubtless railway engineers in this country will read this part of the report with interest, and possibly with some profit.

X-LIGHT.

We call attention to the series of notes on X-light, by Mr. William Rollins, which is again appearing in the ELECTRICAL REVIEW. Mr. Rollins has made an exceedingly thorough study of X-rays and X-ray apparatus, and is especially well fitted to present information on this subject in an instructive and interesting way. Those who are interested in this matter will doubtless be glad that he has again begun his work in this line.

FALSE ECONOMY IN MUNICIPAL ENGINEERING.

Periodically our cities and towns, for some reason or other, review the expense of conducting the government, and are more or less surprised to find it runs so high. A reform is decided upon, and steps are taken to reduce the expenditures. Frequently, the simplest way of doing this is to reduce the salaries of the city officers. An instance of this has cropped up recently in the city of Omaha, Neb., where certain changes in the charter are proposed. Among these changes is a reduction in the salaries attached to certain important and responsible positions.

Proposed Reduction of Salaries of Important Offices.

These so-called economies contemplate the reduction of the salaries of the health commissioner, the city electrician and the city fire chief. It is proposed to pay the health commissioner $1,500 a year, instead of the $2,000 which he now receives. Would it not be more sensible to abolish the position altogether, and save the $2,000 for paying increased physicians' bills?—though this would amount to but a drop in the bucket. The salary of the fire chief is to be reduced from $3,000 to $2,500, although $3,000 a year is certainly small enough compensation for a man who is competent to hold such a responsible position.

City Electrician Should Be an Experienced Engineer.

But the point that touches us most closely is the proposed reduction of the salary of the city electrician from $1,800 to $1,500. It is the duty of the city electrician to watch the city's interests in all electrical matters, and it should be his duty to lay out a comprehensive plan which would provide for all future contingencies. To do this he must understand electric power station work, electric railway operation, power distribution, electric lighting and telephone and telegraph methods; or he must be able to secure assistance from specialists in each of these branches of engineering. He should be able to gauge the future needs of the city, and to give intelligent advice to the city authorities in regard to proper municipal regulations. He should be a man who commands the respect and confidence of his brother engineers, and with whom they are ready to consult on engineering matters which in any way touch the city's interests. He should, in fact, be an engineer of the highest standing and of wide experience, and it is impossible to secure a suitable man for a position of this kind for such an insufficient salary.

Cheap Engineer Not an Economy.

Now, such men command high salaries, and it is absurd to expect to get one for $1,500 per year. No doubt there would be many men who would be willing to undertake the work for that remuneration, but such men, however good their intentions, most certainly have not had the experience which is necessary to fit them for the position; and an incompetent or inexperienced man may easily cost the city many times what he receives. No matter how well a particular piece of work may be done, it represents money wasted if the growth of the city necessitates doing it over again within a few years.

If the people of Omaha think they can secure a suitable man for the salary mentioned, of course it is their own affair; but it is safe to predict that this action will be regretted many times in the future, although the direct cause of complaint may not be apparent.

AN AUTOMOBILE CONTEST.

The Automobile Club of America has sent out the prospectus of a commercial vehicle contest which will be held in New York city on May 20 and 21, next. Following the same general plan of the touring contest held last fall, this contest is intended to test the capabilities of the various commercial or working vehicles driven by electricity, steam or gasoline. The route is to lie entirely within the city, and as far as possible, conditions are to be practically those of actual service. Each vehicle is to carry a load equal to at least seventy-five per cent of its weight, and is to make a specified number of stops. The length of the daily run will be forty miles and time will be allowed for charging batteries, or renewing supplies of water and fuel.

Cost of Running Will Be Determined.

A record of the supplies used by each machine will be kept and the cost of running each vehicle computed from these. While these data will be valuable as well as interesting, too much importance must not be given to them. The true cost of operating a machine includes the expense of repairs and a liberal allowance for depreciation, and as the machines entered will surely be in first-class repair it will be impossible to determine the cost of repairs which would be incurred while in actual service. As giving, however, the comparative cost for power for the different types of vehicle the data will be useful, as there is little or no reliable information on this at present.

One regulation for electric vehicles is not stated clearly in the prospectus, but this is not intended to be complete. It is to the effect that voltmeter and ammeter readings are to be taken before and after each run, and before and after each charging. But nothing is said of the method of making the ammeter readings, it is not clear what they will show or of what value they will be. The ammeter reading will, of course, depend upon the work the machine is doing when the reading is taken, that is to say upon the grade of the street, and the current reading will be less after charging than before, if the grade is easier. It would be well to have the regulations for electric vehicles submitted to a battery expert before adopting them, with the object of learning all there is to be learned from the test.

Cost of Operation Not the Only Consideration.

While much may be learned from this contest, it must not be thought that it will decide the relative value of the different types of vehicle. Of equal, if not of greater importance than the cost of operation is reliability. A truck which can be depended upon to do its work six days in the week is more valuable than one which, though it may cost less to run and to keep in repair, is frequently put out of service for some minor breakdown. And another and vitally important consideration for city work is ease of control, though this will probably figure but slightly in the published results of the contest. But, as stated above, the results of the contest will have a decided value and it is highly to the credit of the Automobile Club of America that it has the public spirit to thus carry out this enterprise.

POWER FROM THE BLAST FURNACE.

BY GEORGE E. WALSH.

The utilization of waste gas for heating, illuminating and power purposes has stimulated unusual investigations and experiments in the field of economical gas production. Producer gas companies have been organized in different cities to supply fuel and power, and their success has been more than promising. Gas consumption is increasing rapidly, and within a decade producer gas will form a much larger percentage of our fuel than ever before. By manufacturing producer gas for power and heat purposes, something like one-half of the total consumption of coal would be saved. The great efficiency of gas in power plants has become an important factor in our industrial development. The gas engine has been developed and introduced so widely that it is rapidly displacing other forms of engines, and scores of these small, clean, portable gas engines are being used where none at all was considered available before. Small printing establishments, which were not situated for steam power equipment, are now being installed with small gas engines to run the presses, while in street work contract jobs can be done to-day by means of a small portable gas engine because of the ease of obtaining fuel wherever needed.

The development of the gas engine of large units has reached a point within the past year which enables large factories and power plants to adopt gas. There is another line of development in gas engines which promises to change industrial conditions to a remarkable extent. The gas turbine is now considered a possibility in the near future, and inventors are working toward this end with renewed hope. The use of the steam turbine for electrical power-houses has rapidly increased, but the gas turbine would even be a nearer approach to the ideal method of converting coal into energy. The gas engine of to-day is peculiarly serviceable in generating electric power. This is so well known that in large cities there is a constant demand for cheap producer gas by electrical concerns, and some of the largest have even drawn their plans for producing their own gas and using it for gas engines to drive their electrical generators.

But probably the most promising field for economizing in power production is in utilizing the waste gas of the blast furnace. The enormous amount of waste from the blast furnace indicates a field for exploitation that is revolutionizing. It is claimed by all who have studied the question closely that the blast furnaces may in the near future be great gas producers, while the production of pig iron will be only of secondary importance. In other words, the gas which was formerly wasted is now considered, when collected and burnt in the gas engine, of more value than the pig-iron product. The different methods employed in the past for using this gas by burning it to make steam were always inadequate, and the amount recovered in this way did not figure conspicuously.

Our production of pig iron has steadily increased in the past year, and a number of new large blast furnaces has been erected. Each one of these groups may become the centre of electrical manufacturing industries which will be of prime importance. For the production of each ton of pig iron, it is estimated that there is generated 13,587,330 B. T. U. or 10,589.62 pounds. This enormous amount of gas produced by the blast furnace in the manufacture of pig iron must either be wasted or used. The most recent use of it is in the internal combustion or gas engine. By these means the waste of the gas is reduced to a minimum, and the maximum of efficiency is obtained.

In Europe the utilization of the waste blast furnace gas has been more active than in this country, and according to a recent report there were upward of 175,000 horse-power of blast furnace engines in successful operation in continental Europe. Germany has led all other nations in this respect. The gas engine of large and small units has also received its greatest development in that country. The absence of waterfalls and rivers for harnessing for manufacturing purposes has been partly responsible for this. The German inventors and experimenters have consequently turned their attention to the development of the internal combustion engine, which would enable them to develop high-tension current power for electrochemical work. The majority of the gas engines in operation in Germany are over 500 horse-power, and a number are as high as 1,000 and 1,200 horse-power. Some are as low as fifty horse-power, and these are employed with great advantage in small stations and power-houses.

The question of how much of the gas from the blast furnace can be utilized in the modern large gas engines is one that has been pretty amply tested abroad and in this country. One pound of blast furnace gas generates 1,283 B. T. U., and from twenty to thirty per cent of the heat energy in the gas can be utilized. This amount of energy can then be depended upon.

It is a simple matter of multiplication and calculation to demonstrate then how much power can be obtained from a blast furnace. One horse-power-hour is equivalent to 2,545 B. T. U., or 7.93 pounds of gas. After making due allowances for waste, it is estimated that the escaping gas from the blast furnace in the making of one ton of pig iron per hour would yield, if properly burned in a gas furnace, 1,097.76 horse-power-hours. This vast amount of wasted power would be sufficient to operate a large-size electrical plant.

The importance of this is further emphasized when we consider the industry of pig-iron production in the United States. The average rate of production of pig iron amounts to nearly 1,500,000 tons per month. The gas generated by the blast furnaces for making this amount of pig iron would be sufficient to run several manufacturing plants, and incidentally produce more power for electrical purposes than Niagara. The power generated by the gas could furthermore be utilized for running the blast furnace plants, and still leave a surplus more than three times as great for other purposes. The operation of pumps and blowing engines by steam generated by the coal as fuel could be replaced by electrical generators driven by the gas engines.

A concourse of light motor-propelled boats has been lately held on the Waunsee, near Berlin, and brought out a number of the latest electric and petrol launches. A number of speed tests was held which showed that the electric boats were not behind the petrol as has been supposed. One of the electric launches, the Frida, made the best record for speed, having covered the distance of fourteen miles in ninety minutes under a strong head wind. This boat represents the latest progress in this line, is sixty feet long by 6.2 feet maximum width with a 2.7-foot draught. It will carry thirty persons when fully loaded, but during the concourse it only carried sixteen. It is equipped with 180 cells of accumulators which supply a motor of twenty kilowatts. At the start the battery showed 152 volts, and at the end of the trip it had fallen to 138. The current fell from 140 to 120 amperes. Another new accumulator boat is a pleasure yacht built in Russia. Its double-bladed helice is operated by a Bergmann motor which gives 400 revolutions per minute, and the controller allows five different speeds. A set of sixty-four Monobloc cells is used which gives 360 ampere-hours on a three-hours' discharge. The battery is used in two portions which are connected in series or in parallel.

The Cincinnati, Georgetown & Portsmouth Railroad Changed from Steam to Electric Traction

By E. M. Stevens, General Superintendent.

THE Cincinnati, Georgetown & Portsmouth Railroad Company was organized in 1872 and received its charter from the state of Ohio soon afterward. The company was chartered to build a railroad (commonly called steam railroad) from Cincinnati, Ohio, Hamilton County, through Clermont, Brown, Adams and Scioto counties to Portsmouth, Ohio. The road was completed first to Bethel, Clermont County, Ohio, and equipped and built as a narrow-gauge railroad, but was afterward extended to Georgetown, Ohio, the county seat of Brown County, to which town the road has always been and is now in operation. On October 1, 1901, the road was purchased by A. W. Comstock, of Detroit, Mich., and W. R. Todd & Company, of Cincinnati, Ohio, the present owner of the road.

Plans were immediately made for changing from narrow gauge to standard gauge and equipping the road with electricity instead of steam.

During the past year this change of equipment has been going on and several extensions have been added to the original road, namely, from the main line at the new Cincinnati waterworks a branch has been built to Coney Island, which is one of Cincinnati's famous summer resorts, and from the power-house, which is located at Olive Branch, about fifteen miles from Cincinnati; another branch line has been constructed to Batavia, Ohio, the county seat of Clermont County, connecting the main line with the Norfolk & Western Railway. Its lines now comprise fifty miles of road, all of which except five miles were until lately laid to a three-foot gauge with forty-pound iron and sixty-pound steel rails. At present, new seventy-pound steel rail has been laid over about one-half of the road, the other half having been laid recently with sixty-pound steel rail. New standard ties throughout the entire length of the road have been put in, and washed gravel of a very excellent quality is being used to ballast the road, so that when finished the road-bed will be of the highest order.

This road traverses high table-land, and owing to the difficulty in reaching this table-land through heavy cuts and deep fills, there were, up to the time the change was contemplated, thirty-seven wood and steel trestles on this road. Nearly all of these wooden structures have been filled up with earth and the balance have been strengthened so as to permit heavy standard locomotives, passenger and freight cars to pass over them. Nearly four hundred thousand cubic yards of material have been used in making these fills.

The right of way is owned in fee simple, the majority of it being sixty feet wide with ample sidings and facilities for freight business in all of the towns through which the road passes. In addition to this right of way, the company owns valuable terminals in the city of Cincinnati, where it has an excellent connection with the Pennsylvania Railroad which receives and discharges all freight, which it does now with the standard equipment. In addition to the terminal facilities in Cincinnati, the road has terminal facilities in the new Cincinnati waterworks, Amelia, Batavia, Bethel and Georgetown. A right of way has been secured and the survey completed to extend this line from Georgetown, the present terminus, to West Union, Ohio, the county seat of Adams County, a distance of twenty-three miles in an easterly direction. The right of way is private and the maximum grade encountered in this extension will not be in excess of one per cent. The average grade of the main line at the present time is less than one per cent, so that the operating expenses of this road necessarily will be small as compared with the ordinary traction roads.

The territory through which this road runs is largely agricultural and is of a high order. Thousands of acres of this country produce great quantities of fine fruit of all kinds, berries, tomatoes, tobacco, grains, cattle, hogs, etc. There are numerous canning factories along the railroad which do enormous business. The county is fairly thickly settled, the farms being for the most part small.

It is estimated that with the increased facilities, which the electrical service will give, the passenger business ought to be trebled. There are no franchises to mature in twenty-five years, as the charter is perpetual. There is no travel to encounter, such as the ordinary traction roads encounter along the highway. There will be no clouds of dust arise from heavy travel along the turnpikes. The possibilities for high speed are great, and it is expected that an average speed of about forty miles an hour will be maintained with the utmost safety to operation. The scenery is picturesque, and traversing a private right of way as it does, the frequent stops which always occur on the highway will be obviated.

At Olive Branch, where the power-house is located, there has been constructed a lake which covers ten or twelve acres of ground. The company owns about fifty acres of ground here and this will be laid out and made a pleasure park. It is proposed, and already a company has been negotiating, to construct a large summer hotel at this place. The elevation at this point is about one thousand feet above sea level, or about five hundred feet above the level of Cincinnati.

The electrical equipment now consists of the most modern that is known at the present time, the power-house at Olive Branch is built of brick and concrete and is modern and up to date throughout, and is said by experts to be one of the finest of its kind in this part of the country. Reference is here made to the following report of Mr. James Bryan, electrical engineer, which gives a description of the power plant as at present installed.

"PITTSBURG, PA., October 11, 1902.
"MESSRS. W. R. TODD & COMPANY,
Cincinnati, Ohio.

"GENTLEMEN—As per your request the following description of the power plans and substations of the Cincinnati, Georgetown & Portsmouth Railway, *viz.:*

"The power-house building, including boiler and engine rooms, measures 151 feet 10 inches by 95 feet 10 inches. The engine room measures 151 feet 10 inches by 45 feet 6 inches, and the boiler room is of similar length, measuring from centre to centre of walls 48 feet 6 inches. The building is of brick, with steel roof trusses, slate roofing on two-inch tongued and grooved sheeting. The boiler house is arranged for four batteries of boilers of 500 horse-power each, there being two 250-horse-power boilers in each battery. The boilers are Cahall-Babcock & Wilcox water-tube boilers, there being a smokestack for each battery of boilers. There are at present installed three of these batteries with a total horse-power of 1,500. The foundation for an additional battery is constructed ready for its in-

stallation, if required, at some future date.

"In the boiler room are two Worthington boiler feed pumps, each of sufficient capacity for feeding 2,000 horse-power of boilers. There is also one 2,000-horse-power Stilwell & Bierce open-type heater, together with all piping and fittings required. Coal storage is arranged alongside of the boiler room, so that cars can be run on trestle track and the coal dumped into bin.

"There are foundations for three cross-compound engines constructed together with foundations for exciter engine, rotary converters and switchboard.

"There is a space at one end of the engine room, measuring 14 feet by 45 feet, partitioned off by brick wall, for transformer room. In the opposite end of engine room is pump pit, measuring 22 feet by 45 feet, the floor of this pit being some 14 feet below the level of engine room floor.

"There are at present installed two cross-compound, condensing, Hamilton-Corliss engines. The dimensions of these engines are: High-pressure, 24 inches in diameter; low-pressure, 44 inches in diameter, and having 42-inch stroke and designed to operate at a speed of 90 revolutions. Connected to these engines are two direct-connected, Westinghouse, 600-kilowatt, 3,000-alternation, 360-volt, three-phase, alternating-current generators. There is also in the power-house one Harrisburg exciter engine, directly connected to a 50-kilowatt Westinghouse generator; also one Westinghouse motor-driven exciter set, consisting of one 75-horse-power, 360-volt, three-phase motor, directly connected to one 50-kilowatt, 110-volt generator. There are also in the power-house two 250-kilowatt, 25-cycle, 360-volt, alternating-current, 600-volt, direct-current rotary converters, together with marble switchboard complete, for control of generators, rotary converters, and having switchboard panels for the control of long-distance transmission circuits. There are in transformer room, six 200-kilowatt, 360-15,000-volt step-up transformers, together with circuit-breakers, lightning arresters for long-distance transmission.

"The condensing apparatus consists of one central condenser of sufficient capacity for the operation of the three units for which the station is equipped.

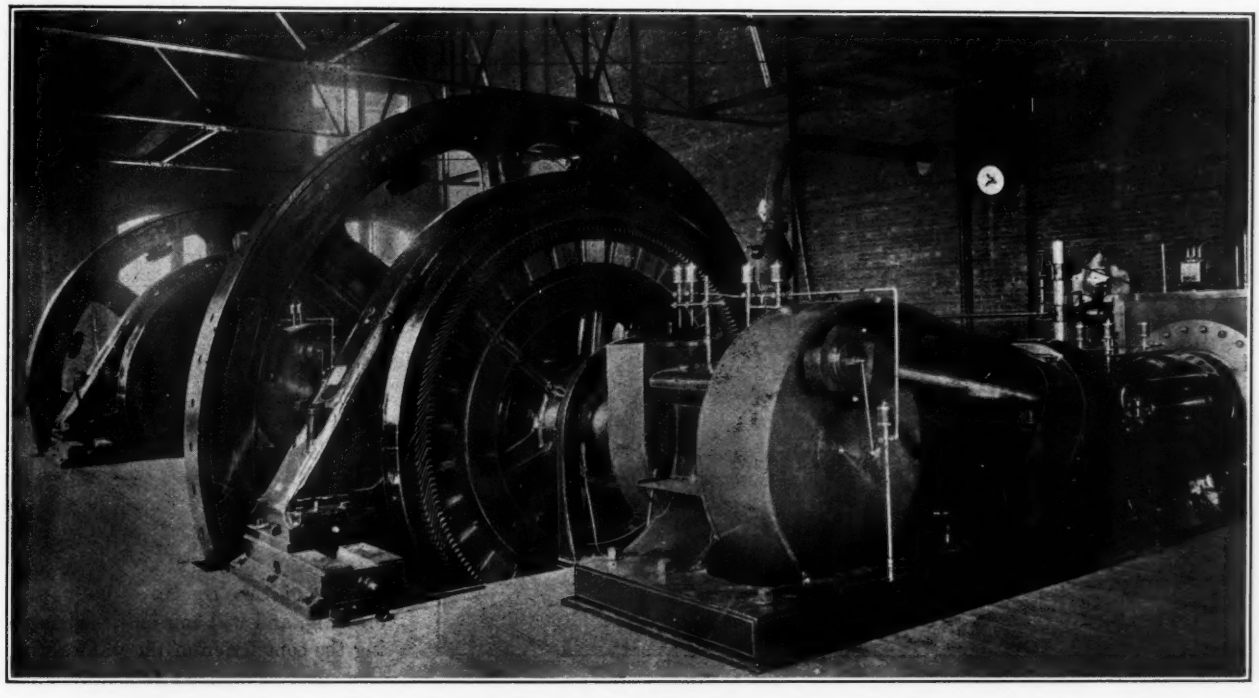
"The water supply was obtained by building a dam across a natural ravine, through which flowed a small stream. The width of the lake thus formed will average about 300 feet wide by 3,000 feet long, with an average depth of sixteen feet, this lake giving ample and permanent supply of pure water.

"There is, in addition to the converting apparatus in the main power-house, three substations, located one each at Mt. Washington, Bethel and Sunshine; these substations being located so as to feed current to the line a distance of five miles each way. These substations are also designed to answer as freight and passenger stations. The substation at Mt. Washington is a brick building, measuring 72 feet by 30 feet 3 inches, the freight room measuring 13 feet of the length and the waiting room measuring 13 feet of the length, the middle portion of the building being divided for the installation of the electrical apparatus.

"The electrical apparatus installed in this substation is as follows, *viz.:*

"Two 250-kilowatt, 360-alternating-current, 600-volt, direct-current, 25-cycle Westinghouse rotary converters, and three 200-kilowatt, 360-15,000-volt, step-down transformers, together with switchboard having alternating and direct-current panels, lightning arresters, choke coils, circuit-breakers, etc., complete.

"The substation at Bethel is of similar design, excepting that the waiting room and freight room are larger, the freight room being 19 feet, and the waiting room 17 feet wide, and the over-all dimensions being 81 feet 4 inches. The general design of this substation is architecturally superior to the substation at Mt. Washington, there being at one end a covered platform 25 feet wide to serve as a waiting space in the summer time. The electrical equipment of this substation consists of two 150-kilowatt rotary converters and three 100-kilowatt, 360-15,000-volt step-



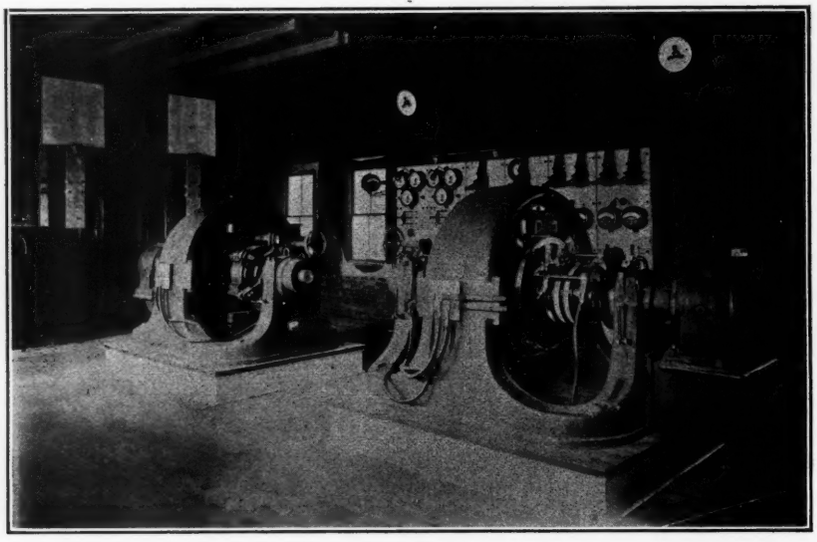
TWO 600-KILOWATT, ALTERNATING-CURRENT, ENGINE-TYPE GENERATORS, INSTALLED IN THE HIGHLAND PARK POWER-HOUSE OF THE CINCINNATI, GEORGETOWN & PORTSMOUTH ELECTRIC RAILROAD.

down transformers, together with switchboard and auxiliary apparatus.

"The substation at Sunshine is similar to the substation at Mt. Washington, excepting that waiting room is omitted and electrical apparatus installed in Sunshine substation is similar to the apparatus installed at Bethel.

"The line construction is span wire, there being two 000 trolley wires, supported by span wire from poles measuring 30 feet on one side and 36 feet on opposite side of track.

"The long-distance transmission lines are supported on cross-arms on 35-foot poles. The construction of the trolley line and the high-potential transmission line is of the most substantial character, care being taken by the use of special cross-arms and special extra heavy pins and insulators to guard against stoppage of operation through mechanical failure of the transmission lines.



ROTARY CONVERTERS AND SWITCHBOARD, AT SUBSTATION, CINCINNATI, GEORGETOWN & PORTSMOUTH ELECTRIC RAILROAD.

"Provision has also been made in the construction of the transmission line eastwardly from the power-house for the installation of an additional three-phase circuit to be used in event of the extension of the line eastwardly.

"The trolley car equipment consists of ten passenger cars, having 40-foot bodies with a length of 50 feet over all, and a width of 8 feet 10 inches, and three combination cars of the same type and make; six open passenger cars 40 feet over all, width 8 feet 4 inches; six closed passenger cars, 40 feet over all, width 8 feet 4 inches.

"These cars are mounted upon trucks of the Pullman type, built by the St. Louis Car Company. These cars are built in the strongest manner possible, and finished in the best manner; the equipment consists of four No. 56 Westinghouse motors with type K 14 controllers.

"There are also in process of construction three express and mail cars to be mounted on trucks of similar type to the passenger coaches and to be equipped with similar electrical equipment.

"Yours truly,

"(Signed) J. BRYAN,

"Engineer."

Including that mentioned in the above report, the rolling stock consists of the following:

Ten fifty-foot closed passenger cars, Pullman type, equipped with four sixty-horse-power Westinghouse motors; six forty-foot open cars, equipped with four No. 68 Westinghouse motors; six forty-foot closed cars. The latter twelve cars were built by the Cincinnati Car Company, and the former ten cars were built by the St. Louis Car Company. In addition to these passenger cars, there are two express, mail and baggage cars equipped with four sixty-horse-power Westinghouse motors, and one combination baggage and passenger car equipped with same; ten standard flat cars, equipped with Westinghouse air-brakes and automatic couplers; ten standard coal cars; ten standard box cars; ten standard stock cars.

The company has secured excellent facilities for receiving and delivering both passengers and freight at convenient points in the city of Cincinnati.

With respect to the passengers, the company has entered into a contract with the Cincinnati Traction Company, which it is believed is a most advantageous arrangement for this road, as, under the terms of the agreement, the cars of the Cincinnati, Georgetown & Portsmouth Railroad are permitted to run in over the tracks of the Traction company to the very heart of Cincinnati. The use of the tracks, together with power and overhead equipment, is supplied by the Traction company. Under the arrangement, the headway allowed by the Traction company is ten minutes, so that the convenience may be secured of having the cars of the company operating for a distance of five miles over the tracks of the Traction company and serving a population immediately tributary to the same of not less than two hundred thousand people.

The branch of the Traction company over which the cars of this company will operate is the most heavily traveled of any line in Cincinnati, hence the advantage accruing to the railroad company because of the large population served. The railroad company furnishes the cars and crews to operate the same, and the cars are run under the rules and regulations which apply to the cars of the Traction company.

All the freight handled by the Railroad company is received at Carrol street by the P. C. C. & St. L. R. R., for delivery in Cincinnati. Freight is also delivered by the latter company to the Cincinnati, Georgetown & Portsmouth Railroad to be transported over the same. There is an enormous amount of freight handled daily by the road for the city for use in the construction of the new waterworks. The volume of this freight is constantly increasing, and will continue, not only during the completion of the waterworks, but thereafter as well, as this railroad is the only one connecting with the waterworks. The company has entered into a contract with the city of Cincinnati which runs for thirty-five years, under which its branch or spur running into the grounds of the waterworks is being operated. This arrangement or contract with the city of Cincinnati is regarded as a very valuable asset of the company, and will doubtless prove of signal advantage to the company during the years to come.

Electric cars were first run on a regular schedule, December 1, 1902, and the receipts to date have been twenty-five per cent more than during the corresponding time last year, although the fare has been reduced one cent per mile. The present regular rate is two cents per mile, with a slight reduction for mileage, trip tickets, etc. During the past season, the Coney Island branch, which had already been equipped for electric traction, carried over 65,000 people per month.

The operating expenses and taxes during 1901 were $69,508, or about 81.5 per

cent of the gross earnings. The net earning were $17,826, of which $10,080 was used in payment of interest on bonds, and $7,778 in meeting other charges. The general balance-sheet of the road on June 30, 1901, showed that the common stock paid in amounted to $400,000, the preferred stock $125,000, and the funded debt at four per cent, $252,000. The other liabilities brought the total up to $809,708.

The business of the company in freight, express and passenger traffic has shown a steady increase for a number of years. This increase has been more marked since the present management has had charge of the property. It is believed that, with the use of the electric motive power recently installed, the business of the company will be augmented many fold. Under the old régime but two passenger trains were run each way daily. It is now proposed to have at least hourly service each way over the entire line, with half-hourly, or even more frequent service to points near the city, including Coney Island and other near-by popular resorts.

The following table, showing the revenue of the road for the past five years under the old system, shows how the company's business has been increasing, and gives some idea of what may be expected under the improved service now furnished:

EARNINGS OF THE CINCINNATI, GEORGETOWN & PORTSMOUTH RAILROAD.

FOR YEARS ENDING JUNE 30, FROM 1897 TO 1902.

Year.	Freight.	Passenger.	Mail.	Express.	Miscellaneous.	Total.
1897.....	$15,592.46	$34,195.72	$4,001.66	$5,819.26	$623.70	$60,232.80
1898.....	19,170.02	33,768.79	3,963.82	6,164.55	249.96	63,317.14
1899.....	21,842.55	37,010.83	4,004.95	6,645.32	588.90	70,092.55
1900.....	25,784.02	42,856.02	4,127.40	7,300.84	1,365.69	81,433.97
1901.....	26,027.80	46,149.73	4,158.80	8,244.57	752.80	85,333.70
1902.....	41,541.74	52,866.02	4,091.00	9,107.88	2,470.11	110,076.75

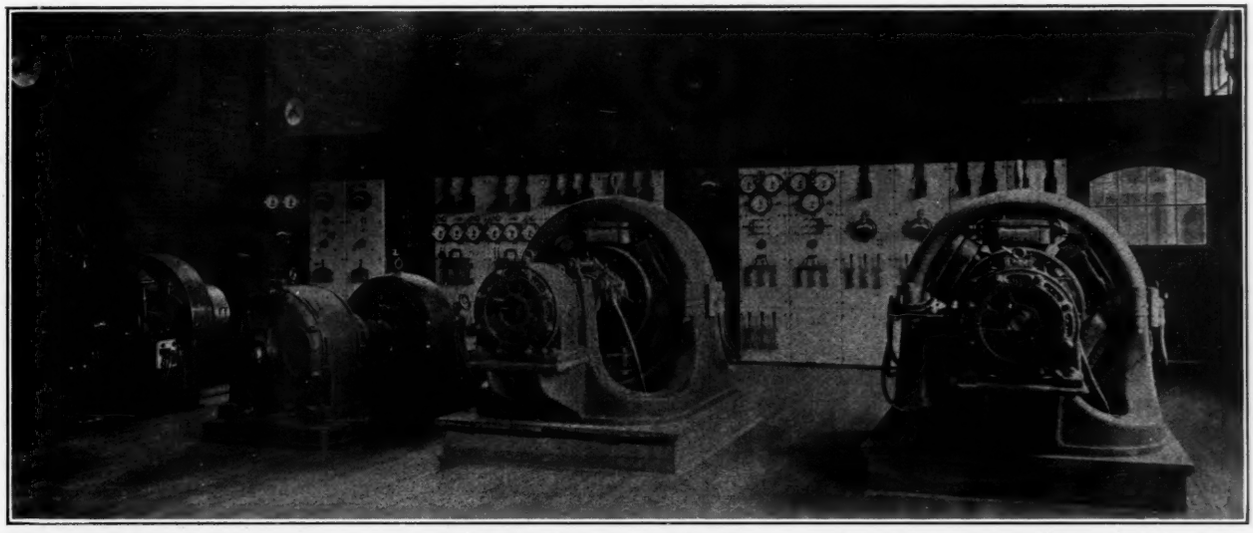
The present earning capacity of the road being ample for protection, the stockholders, on December 3, 1901, authorized an issue of $1,500,000 new stocks and $1,000,000 bonds, having the same date canceled all of the old bonds and stocks.

Electrical Notes from Europe.

By C. L. Durand.

A FEW years ago the Orleans Railroad installed a short branch of electric railroad in Paris, which runs along the Seine within the city limits and connects the Austerlitz depot with the new depot which has been erected on the Quai d'Orsay. As the operation of this short line has proved quite successful, the company is now taking measures to extend the electric portion of the road toward the suburbs to the south of the city, and proposes to run a four-track road as far as Juvisy, which is at a distance of fifteen miles. The railroad company has recently submitted a project of this nature to the Minister of Public Works, and at the same time is making arrangements with the Thomson-Houston company to carry out the work and furnish the material for the new section. The system of distribution used in the new part will be the same as before. The generating station will produce three-phase current at 6,000 volts and twenty-five cycles. Two substations will be erected to supply the new section, and the current will be transformed to continuous current at 600 volts to feed the line. The generating station will be provided with a battery of accumulators of the Union type, giving 1,500 ampere-hours in order to provide for the irregularities of load. It is proposed to build a number of new electric locomotives which will draw trains made up of the ordinary railroad cars, and making a speed of fifty miles an hour, besides a type of motor car of the double-truck pattern with motors mounted upon each truck. The car will have a cabin at each end for the motorman and the various controlling devices, leaving the middle part for the passengers, somewhat as in the Metropolitan system.

The new generating station which is now being erected at Antwerp for supplying the traction lines of the city will soon be completed. The main dynamo room is 330 feet long and 160 feet wide, and will contain two rows of direct-coupled generating sets ranged on each side of a central passage. The engines are built to furnish 750 horse-power on normal running, but may work as high as 1,200 horse-power. The eight engines forming a row are connected together by steam piping and are supplied by a boiler house located along the main building on each side. The building is now practically finished, and three of the groups will soon be installed to commence with. The lighting is to be carried out by three-phase alternators of 700 kilowatts capacity, working at 6,300 volts. The alternators are to be excited by direct-current machines giving 120 volts, coupled to three-phase motors. In addition to the exciting dynamos a battery of accumulators is to be provided which will be charged at 120 volts from the exciters



150-KILOWATT ROTARY CONVERTER, HIGHLAND PARK POWER-HOUSE, CINCINNATI, GEORGETOWN & PORTSMOUTH ELECTRIC RAILROAD.

and act as a reserve. The alternators will also supply current for different electric motors which will be used in the machine shops connected with the station, and also to operate the pumps of the boilers, besides the transport of the coal and automatic loading and conveying apparatus. The number of boilers used in the station is to be reduced as much as possible on account of the high efficiency of the engines which have been adopted, and the constructors have guaranteed one horse-power-hour for fourteen pounds of steam. The station is well situated as regards the coal supply, as the boats will unload the coal on the wharf running alongside the station, and it will be stored in coal-pits of large capacity. The coal will be conveniently handled by means of different electrically operated conveyors. If need be a coal supply can also be obtained from the railroad which runs near the station.

The French Government has lately made an important decision relating to aerial telegraphy, and has issued a decree to the effect that hereafter the state is to have the monopoly of establishing wireless telegraphy stations and providing for communications of either an official or a private nature. This will fall to the charge of the Postal and Telegraph Department, which will control the new system in the same way as the telegraph and telephone lines. This decision was made after a report which was presented by the Minister of Commerce. This report states that at present the subject of aerial telegraphy is being actively taken up in France, and the different departments, such as the Marine, Colonies and Public Works, have already commenced to establish posts for official use, and the question of communicating from the maritime posts to the war fleet and private vessels occupies a prominent place. Another point to be considered is the communication from the shore to certain islands, especially in the colonial possessions, and the new system may either replace or run parallel to the existing cables. But in the present state of the science it seems impossible to count upon a complete security in the exchange of the messages, so that two adjacent posts can work without disturbing each other, and it is possible that one post may receive messages intended for the other. It is foreseen that considerable trouble may arise from the establishment of different aerial telegraphy stations throughout the country, and the minister concludes that these will be best avoided by carrying out all the work under the direction of the government. Seeing that the state already possesses the monopoly of the telegraph and telephone system it is quite in order that it should also assume that of aerial telegraphy. The laws of May 2, 1837, and December 27, 1851, secure to the government the monopoly of all transmission of correspondence by telegraphy or other means. The minister claims that the government is well acquainted with the needs of the public and will be fully able to supply them. As the new system needs skilled operators, the Telegraph Department has a well-trained personnel which is no doubt better qualified for this work than others. In the case where the new system would replace or run parallel to submarine cables the connection will be made to foreign countries, and it is especially important that the department should have control of these lines.

The question of substituting electric traction for steam upon the state railway system of Sweden is now being discussed. Some time ago a commission was appointed by the authorities to look into the matter; it was made up of a number of prominent electrical engineers and railroad officials. The commission has lately presented a provisory report which favors the substitution of electricity for steam, but proposes to bring about the change gradually. Alternating current is found best adapted to the existing conditions, and this would be supplied at a sufficiently high tension. To feed the existing system of railways in the country it is proposed to build no less than twenty-two large generating stations, and these would supply the line at seventeen different points. The country to the north and central region has a number of powerful waterfalls which are not used at present and many of these could doubtless be employed for the new stations. In the southern region it is probable that five central stations could be supplied with the peat briquettes which are made in that part of the country. The commission recommends that the change be brought about gradually so as to acquire a sufficient experience in the first installations before changing the system completely.

The same question is also being agitated in Hungary, and the Minister of Commerce, in a discussion of the railway budget for 1903, states that the question of using electric traction on the state railroads has attracted the attention of the government. Some time ago a prominent engineer was sent to different countries to gather details and make a report on the subject of electric traction on main railway lines. This report bears principally on the new Italian lines, and there is no doubt that important results have been obtained here, but it must be remembered that the introduction of the system is amply justified by the absence of coal mines and the necessity of importing the coal at great expense. The question is to be considered by the Hungarian Government, and the first experiments will be preferably made on the passenger system, leaving the freight service out of the question for the present.

The yearly statistics of the Prussian Government relating to the number of engines and the power used in the production of current show a marked increase for 1902 over the preceding figures. In some cases the engines are used exclusively to produce current, and in others they drive dynamos in connection with other machinery. The increase in the total number of engines, as well as in the power, is best remarked by comparing the figures for the period 1891-1902, the latter year being given up to April 1. A sufficient idea may be obtained by comparing the years 1891, 1898 and 1902, which give, respectively, a total of 983 engines and 49,489 horse-power; 3,305 engines and 258,726 horse-power; 4,928 engines and 573,405 horse-power. It is seen that the power has increased more than ten times since 1891. As concerns the uses to which the current is put, the figures for 1902 are subdivided as follows: For lighting alone, 3,624 engines giving 206,328 horse-power; for motors alone, 139 engines giving 33,168 horse-power; for both together, thirty-nine engines and 8,774 horse-power, the remainder being used for several purposes at a time, figuring 1,126 engines and 325,125 horse-power, of which lighting and power also form a large part. The Rhine provinces in which the industries are so well developed come first in the use of current, having 1,182 engines and 126,932 horse-power, then follow Westphalia, Silesia and Saxony, all of which have a greater number of engines than the Berlin district, but the total power is less. The Berlin district has in fact but 335 engines, but many of these are large units, which bring the total power up to 79,845 horse-power.

In Germany, electricity, among other curious results, has rehabilitated the discarded windmill. At Neresheim a windmill supplies power for thirty-six incandescent lamps that light a large paint factory. Another in Schleswig-Holstein keeps up a steady current of thirty volts. At Düsseldorf a windmill winds up a heavy weight, the descent of which works a powerful dynamo.

INDUSTRIAL ELECTROCHEMISTRY AND ELECTROMETALLURGY—XII.

Notes on Progress in Europe and America.

BY JOHN B. C. KERSHAW.

Nickel.

In the note dealing with the nickel mining and smelting industry in Canada, which appeared in the issue of the ELECTRICAL REVIEW for January 31, 1903, the writer referred to a new electrolytic process for parting copper-nickel alloys patented by the well-known electrometallurgist, Titus Ulke. The inventor has recently described this process in the *Electrochemische Zeitschrift,* and the following details of the process are based on the information contained in that journal. The process is protected by U. S. A. patent No. 604,699, and by Canadian patent No. 75,192. It can be applied to all alloys of two metals, where one of these can be deposited from an acid solution with a low current density and a low electromotive force, and the other from a neutral or alkaline solution under reverse electrical conditions. Copper and cadmium are typical metals of the first class, while nickel, cobalt and zinc are representative of the second class. The process is continuous in working, and in this respect differs from all previous electrolytic processes for separating nickel and copper. The alloy of copper and nickel containing most suitably twenty per cent of the latter metal is used as anode material in a bath containing acid copper sulphate solution as electrolyte. Copper is used as cathode material, and under these conditions both metals pass into solution at the anode, but only copper is deposited at the cathode. From 2.5 to 3 per cent of the solution in the bath is withdrawn per twenty-four hours at regular fifteen-minute intervals, and fresh copper sulphate solution is added in order to keep up the original concentration. The solution withdrawn contains chiefly nickel sulphate with copper as an impurity.

It is treated with ammonium sulphate and is then allowed to crystallize. A double sulphate of nickel and ammonium is obtained in this way, and if contaminated with much copper this impurity can be removed by recrystallization. The purified salt is dissolved in water, and the solution is then rendered alkaline with ammonia, and is electrolyzed in the hot state with lead anodes and nickel cathodes. According to Ulke this process yields nickel of greater purity and at less cost than any process yet in operation, and he is hopeful that it may prove able to compete with the usually employed "Orford" or "tops and bottoms" metallurgical process. Trials of the new process at Sault Ste. Marie may be expected at an early date.

Zinc Extraction from Composite Ores.

The electrolytic and electrometallurgical processes for the extraction of zinc from mixed ores make but slow progress, and the only process which has been worked upon an extended scale of operations, and is still in industrial use, is that of Hoepfner. The Hoepfner process is designed for use with waste calcium chloride liquors from ammonia-soda works, and a concentrated solution of zinc chloride is finally obtained as a result of the preliminary leaching and chemical operations. This solution is then electrolyzed with carbon anodes and zinc cathodes, in a diaphragm type of cell, and the chlorine obtained at the anode is utilized for the manufacture of bleaching powder.

At Winnington, England, where Brunner Mond & Company has worked this process for some years, 1,663 tons of zinc and 5,000 tons of bleaching powder had been produced up to April 30, 1901; and the output at this works in April, 1902, was reported to be three tons of zinc and nine tons of bleaching powder per day. The zinc obtained tests 99.95 per cent and finds a ready sale to the manufacturers of cartridge cases. The writer is not aware that the Hoepfner zinc extraction process is operated at any other works in Europe; and it is possible that the recent heavy fall in the price of bleaching powder may necessitate a reduction in the output of this chemical at Winnington, unless an exceptionally high price can be obtained for the zinc produced by the process.

As regards other zinc extraction processes, Danneel reports in the *Zeits f. Elektrochemie* of March 6, 1902, that the industry does not develop in Germany; and that the success of the Strzoda process, which was stated to be in operation at Boekenheim and Frankfort, is doubtful. As the Strzoda process depends upon the use of zinc sulphate as electrolyte, this criticism is most probably correct; for all previous attempts to base successful extraction processes on the use of this electrolyte have failed.

The Swinburne & Ashcroft process, which depends upon the decomposition of the ore with hot chlorine gas and the electrolysis of the fused chlorides, is still in the experimental stage of its development; and although a large plant has been erected at Runcorn, Lancashire, no details can be obtained at present regarding the output of zinc. The process has undergone considerable modifications since originally patented; and it is still possible that in its final form the Swinburne & Ashcroft process may solve the zinc-ore problem, which is, to discover a process which will enable the metallurgist to recover all the valuable elements from mixed sulphide ores, containing zinc and lead as chief constituents, with silver, iron and manganese as impurities.

The Production of Oxygen and Hydrogen Gases by Electrolysis.

The production of oxygen and hydrogen by electrolysis would appear to be one of the most flourishing of the minor branches of electrochemical industry, and the fact that the first volume of the "Monographien uber Angewandte Elektrochemie," now being published by the firm of Knapp, of Halle, Germany, has been devoted to this subject indicates that in the opinion of the editor of this series, the industrial development is permanent, and is likely to become still more extensive. Plants for the production of oxygen and hydrogen by electrolysis have been installed at Tivoli, Rome, Milan, Zurich, Lucerne, Hanau, Brussels, Toulouse, Montbard, and Oloron Ste. Marie in Europe, at Aldershot in England, and at Iowa State College and Lehigh University in America. Many different forms of apparatus have been patented, and are in actual use. The majority are diaphragm cells, using a solution of sodium hydrate as electrolyte, and iron or nickel for the electrodes. The Garuti type of cell is of this type, and is perhaps the most widely employed. The Schoop & Schuckert cells are other well-known types. In a large number of instances the gases are utilized for heating purposes. At Hanau the oxygen and hydrogen obtained by electrolysis are employed for melting platinum; and in many accumulator and secondary cell factories in Germany, electrolytic oxygen and hydrogen have displaced hydrogen, obtained by the usual chemical method, for lead-burning purposes. The issue of the *Centralblatt f. Accumulatoren u. Elementen-kunde* for February 15, 1903, contains an illustrated description of the electrolytic plant used, and manufactured, for production of oxygen and hydrogen, at the *Accumulatorenwerke, Gottfried Hagen* in Cologne, in Germany. This firm is agent for the Schoop type of lead decomposing cell, in which sulphuric acid of 1.23 Sp. Gr. is employed as electrolyte, with lead as electrode material. The special feature of this cell is the absence of a diaphragm. The electromotive force required per cell lies between 3.3 and 3.6 volts and the cell yields under normal conditions, 97.5 litres hydrogen and 48.7 litres oxygen per electrical horse-power-hour. Assuming that the latter costs only one cent, a cubic metre equal to 35.3 cubic feet of the mixed gases, can be produced for between four and five cents. The oxygen obtained from the Schoop apparatus is of ninety-nine per cent purity, and the hydrogen, 97.5 to 98 per cent. Readers interested in this use of detonating gas are referred to the issue of the *Centralblatt* named above, or to "Engelhardt's Monograph," published by Knapp, for further information.

Annual Report American Telephone and Telegraph Company.

To the stockholders, for the year ending December 31, 1902:

The results of the business for 1902, as shown by the treasurer's statement appended, were as follows:

Gross revenue	$13,277,457.33
Expenses, including interest and taxes	5,442,185.14
Net revenue	7,835,272.19
Dividends paid	6,584,403.75
Carried to reserve	522,246.71
Carried to surplus	728,621.73

The net output of telephones during the year was 624,714, making the total number in the hands of licensees 3,150,320.

The number of exchange stations at the end of the year was 1,277,983, an increase of 257,336.

The total mileage of wire for exchange and toll service was 3,281,662 miles, of which 836,378 miles were added during the year.

Including the traffic over the long-distance lines, the daily average of toll connections was about 239,700, and of exchange connections about 9,323,000, as against corresponding figures in 1901 of 187,378 and 7,531,761; the total daily average of 1902 of connections, both toll and exchange, reaching 9,562,700, or at the rate of about 3,079,000,000 per year.

The expenditure for new construction to supply the increasing demand of the public for telephone service, was larger than that of previous years, the proportion of increase bearing a close relation to that of the business before recited.

The total amount added to construction and real estate by all the companies constituting this system in the United States during the year 1902 was:

For exchanges	$26,014,800
For toll lines	8,282,900
For land and buildings	3,038,800
	$37,336,500

The amount added in 1900 was $31,619,100; in 1901, $31,005,400.

The expenditure by this company in 1902 for the construction, equipment and supplies required for its long-distance lines was $3,379,982, making the total investment in long-distance lines and equipment to the close of the year $22,496,191.

These figures show that the active development of the business, which has been characteristic of recent years, still continues, nor are there any signs of a diminution of the demands upon this company and its operating companies for increased construction to meet the call for telephone service throughout the United States. There is hardly a section of the country in which it can be said that the point has been reached at which the supply of telephone facilities equals the demand. During the past year the operating companies have made larger gains in their lists of subscribers than in any previous year, and, almost without exception, they look forward to a still greater increase in the near future.

The demand for additional toll lines, and the use of those already constructed, are greater than ever before. A striking illustration of the growth of the toll line business after it is established appears in the fact that the estimate for the coming year, merely for new circuits on the now existing long-distance lines which are operated directly by this company, calls for an amount equal to about ten per cent of the entire investment made to date by this company in its long-distance plant.

Large as has been the investment in the past of this company and the operating companies associated with it, it is clear that to fulfill the duty of giving to the country a complete and comprehensive system of telephonic transmission, there must be a constant extension of facilities, involving a corresponding increase in investment. It is even more true of the telephone business of this company and its associated companies than of any other like business, that the necessary facilities to cover the territory, which, in this case, is the whole country, must be supplied to the full extent required to meet the reasonable demands of the public. The users of telephones recognize the enormous advantage of a complete service such as is afforded by the Bell companies, and expect to pay a proper compensation for the same. There can be no room for doubt that whatever investment is necessary to enable the business to be done properly will receive an adequate return.

During the past year the company received from the issue of new stock offered at par to its stockholders, the sum of $21,226,122; $9,965,550 of this amount was received in January, 1902, from an issue authorized in 1901 and $11,260,572 in September, 1902, from an issue authorized in 1902. The balance of the proceeds of the latter issue was received in January, 1903.

Further stock issues will undoubtedly be necessary in the future.

An essential obligation on the part of this company and the operating companies with which it is associated is to use every effort to give to their patrons the best possible service. To do this the apparatus must be of the best design and quality, and must be installed under the most favorable conditions. More than that, the working force, including not only the telephone operators who come in direct contact with the public, but all those upon whom is imposed the duty of keeping the apparatus in order and of arranging with the public for its use, must be thoroughly trained, as well in the practical part of its work as in meeting and dealing properly with the public.

There is no apparatus more complicated than that employed in telephony when organized on a large scale, and no conditions exist in which a failure to adopt and act upon a high standard, both of mechanism and of relations to the public, is more incompatible with success.

This company and its associated companies are devoting their energies not only to that great development which the public interest requires, and which is so essential to the prosperity of the telephone companies themselves, but also to perfection of apparatus, the discovery of improved methods of operation, and the training and discipline of employés.

In former reports, reference has been made to the many features of engineering and of mechanism in which constant improvements have been made from year to year.

During the past year there has been even greater progress in the same direction. More of the wires in the larger towns have been placed underground. At the present time about fifty-five per cent of the entire mileage of wires used for exchange service throughout the country is in underground conduits. To a greater extent every year the operating companies acquire land and erect buildings specially designed to meet the requirements of modern exchange operation, locating them at points from which the distribution of the wires can be most economically and effectively made.

The introduction of the modern form of switchboard in the place of the older forms has progressed steadily. New and more effective cables have been designed and put into use, and in all the details of the work one improvement after another has been adopted as soon as it appeared that the adoption would contribute to the improvement of the service.

During the past year, special efforts have been made to standardize the apparatus used throughout the country by this company and its operating companies, and to ensure that in all parts of the country the most efficient central office equipment, underground and toll lines, and subscribers' station apparatus were employed. Much attention has been given to methods of operating, and while perfection has not

yet been attained, and probably can never be attained in so difficult an art as that of telephony, there is no doubt that the service of the Bell companies, both long distance and local, throughout the country, has very generally improved. Every effort will be made to improve it still further, both by the introduction of better apparatus and by the adoption of better methods of operating, to the intelligent study of which the best men available are devoting constant attention.

In the report of your directors for the year ending December 31, 1901, the following reference was made to the competition of telephone companies not associated with this company:

Competition from telephone companies not associated with this company has existed for several years, and is likely to continue in some places for some time to come. While it has in some localities affected the licensees of this company disadvantageously, by reducing, for a time at least, the number of their subscribers and forcing them to meet competitive rates that are not based upon a proper recognition of the cost of doing the business or an adequate appreciation of the amount that should be set aside from earnings for maintenance, reconstruction and depreciation, the consequences of the competition to the business as a whole have not been of serious moment. The public in each community will determine for itself whether it is for its advantage that there should be two telephone exchanges serving one body of people. It would seem as if but one conclusion on this point was possible.

In any event, the comprehensive character of the system of this company and its licensees, organized as the system is to afford uniform and adequate telephonic intercommunication throughout the country, and the intention and ability of the company and its licensees to give good service at fair rates, must ensure the permanency and prosperity of their business in the future as in the past.

The developments of the past year confirm the views then expressed. Since that report was presented to the stockholders there has developed a recognition on the part of many of the competing telephone companies, particularly those which were in the business in such a way as to be forced to look the situation in the face, that the rates generally adopted by them were much too low. It was very largely because of the belief on the part of these competing companies that they could do business at rates which were in fact below the cost of supplying the service, that they succeeded in making their competition with our companies in some instances effective by offering to give service at abnormally low rates. Moveover, their apparent views as to what rates were remunerative were, as was but natural, accepted to some extent by the public. It is but reasonable to assume that, by reason of the admissions of many of the most prominent of these competing companies, based no longer upon the representations of promoters but upon their actual experience, the public will be educated to a recognition of what are proper and reasonable rates for telephone service; in which event our companies will be in a position to relieve themselves of what is substantially the only ill effect that has followed from competition, namely, the reduction in certain localities of the rates charged to subscribers to a point which allowed no profit, and in some cases involved a loss.

The public has also in some instances during the past year seriously considered the question whether or not there should be two telephone exchanges serving one community, and has come to the conclusion that a duplication of telephone service was undesirable. We believe that this sentiment will grow, in which event it will be the fault of the Bell companies if their facilities, their service and their relations to the public are not such as to secure for them proper recognition.

The most important single transaction concluded during the year was that briefly referred to in the last annual report, by which the controlling interest in the capital stock of the Western Telephone and Telegraph Company was acquired by this company. The Western company purchased the majority interests in the stocks of the Cleveland Telephone Company, the Michigan Telephone Company, the Northwestern Telephone Exchange Company, the Southwestern Telegraph and Telephone Company and the Wisconsin Telephone Company, before held by the Erie Telegraph and Telephone Company.

The revenue of the Western company, derived from its holdings of stocks and other securities of the above-named companies, during the first year of its organization, has been sufficient to provide for two dividends of two per cent each upon its preferred stock, which were paid in August, 1902, and February, 1903, respectively. The second dividend does not appear in the accounts of the company for 1902.

During the past year, by agreement between this company and the operating companies with which it has contracts, a new and simpler plan for determining the amount to be paid this company as rental for telephones has been adopted, which plan involved a substantial reduction in the rentals paid to this company from and after January 1, 1902. This modification of the rental arrangement was clearly justified by the existing conditions. It is believed that it will work to the advantage, not only of the operating companies, but of this company.

If this reduction in rentals had not been made, the amount carried to surplus on the books of this company for the year 1902 would have been substantially greater.

For the directors,
FREDERICK P. FISH,
President.

COMPARATIVE STATEMENT OF EARNINGS AND EXPENSES.

EARNINGS.

	1901.	1902.
Dividends	$4,988,207.63	$6,023,523.20
Rental of instruments	2,647,907.64	2,299,378.52
Telephone traffic	3,533,446.74	4,199,708.59
Real estate	36,680.16	56,080.54
Interest	399,579.26	698,816.48
Miscellaneous	995.51	....
	$11,606,816.94	$13,277,457.33

EXPENSES.

Expenses of administration.	$772,424.30	$964,827.30
Legal expenses	99,138.04	134,645.57
Interest and taxes	1,276,559.20	1,970,947.99
Telephone traffic	2,060,409.54	2,381,764.28
	$4,208,531.08	$5,442,185.14
Net revenue	$7,398,285.86	$7,835,272.19
Dividends paid	5,050,023.75	6,584,403.75
Balance	$2,348,262.11	$1,250,868.44
Carried to reserves	$1,377,650.74	$522,246.71
Carried to surplus	970,611.37	728,621.73
	$2,348,262.11	$1,250,868.44

The officers of the American Telephone and Telegraph Company are as follows:

Frederick P. Fish, president.

Edward J. Hall, vice-president and general manager.

William R. Driver, treasurer.

Charles Eustis Hubbard, secretary.

New York Electrical Society.

The two hundred and thirty-third meeting of the New York Electrical Society was held March 18. Over 300 members and their friends listened to the lecture of Professor R. H. Thurston, of Cornell University, on "Steam Turbines to Date." The lecture was a masterly summary of the subject.

The following members were elected: J. L. Moriarty, Charles E. Mandelick, Charles E. Wingate, Max J. Levy, Robert Lee Hailey, Farley Osgood, W. B. Spellmire, Frederick J. Chisholm, William H. Moon, John L. Flagg, Oskar Friedrich, Joseph Treanor McNaier, John B. Ketcham, Eugene Toussaint, Arthur L. Case and Joseph W. Scott.

NOTES ON X-LIGHT.

BY WILLIAM ROLLINS.

NOTE CXLVIII—X-LIGHT AXIOMS.

In these notes some principles of importance in the application of X-light to medicine were first stated, illustrations and descriptions of apparatus embodying them being given. A few of these principles which might well be called X-light axioms will be mentioned again as they are of sufficient importance to be repeated until they are adopted.

First Axiom—No X-light should strike a patient except the smallest beam which will cover the area to be examined, photographed or treated.

Second Axiom—No direct X-light should strike the observer.

Third Axiom—The physician must be able to make all the adjustments of the X-light without interrupting the examination by removing his eyes from the image on the fluorescent screen.

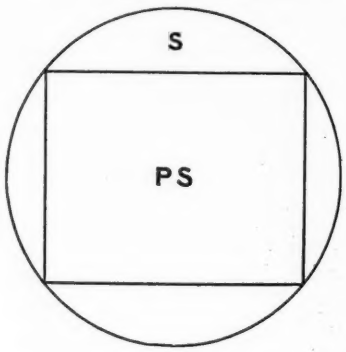
Fourth Axiom—The physician must be able to orient himself in relation to the patient and the source of X-light at all times during the examination without removing his eyes from the image on the fluorescent screen.

Fifth Axiom—To avoid distortion the fluorescent screen must be, during the examination, always held with its surface normal to the central ray of X-light.

It is regretted that the importance of these ideas is not yet recognized, as may be seen by examining the illustrations in books and articles of the writers on the subject and catalogues of makers of X-light apparatus.

The first of these axioms whose importance I discovered was the most obvious—the need of regulating the amount and quality of the X-light while making examinations without removing the eyes from the image on the fluorescent screen. Several means were tried: (A) placing a rheostat controlling the speed of the static machine within reach of the observer's hand; (B) altering the distance between the terminals of the X-light tube by an external magnet operated by a lever within reach of the observer's hand; (C) by a compound spark-gap in series with the tube and operated by a lever within reach of the observer's hand; (D) by a tube in which I operated the Crookes potash regulator automatically by heat produced by electricity and controlled by a lever within reach of the observer's hand; (E) by a rheostat within reach of the observer's hand which regulated the current passing through the primary of the induction coil.

I soon after realized the importance of being able to orient myself in relation to the patient and the source of X-light at all times during an examination, without removing my eyes from the image on



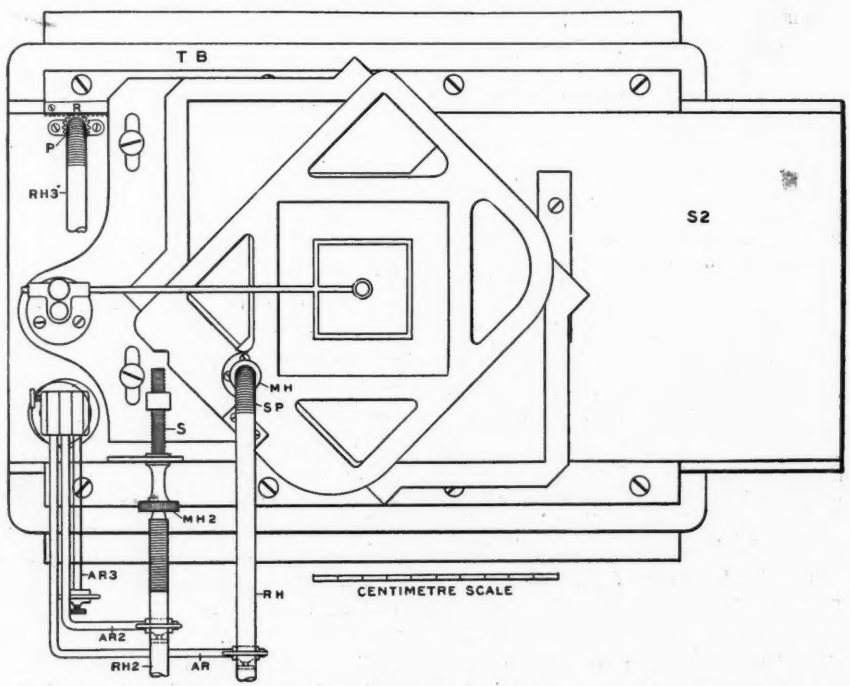
NOTE 149—FIG. 1.

the fluorescent screen. The best method found was described in notes cxv and cxvii, March 19, 1901, and more fully in note cxliii, March 7, 1903. Many mechanical modifications of this will no doubt be made, but to be effective they must embody the principle, the statement of which was one of the valuable contributions to X-light literature.

The importance of allowing no X-light to strike the patient except the smallest beam that would cover the area to be examined, was next recognized. My first attempt to embody this idea in mechanism was described and illustrated in the *International Dental Journal* for September, 1896. The result was an adjustable concentric non-radiable diaphragm plate, which could be centered with the central ray of the source of X-light used to illuminate the patient; the area of the beam being limited by the size of the hole in the diaphragm. The next to enclose the tube in a non-radiable box having a similar non-radiable diaphragm.

The importance of allowing no direct light to strike the observer was naturally the last to be recognized. The means to prevent this were to employ the smallest diaphragm, that the observer might be beyond the beam of X-light, and the use of a non-radiable fluoroscope, when the examination required him to stand in the direct beam; illustrated in note cxvi, February 2, 1901, and described in note cxxxix, June 14, 1902; again described and illustrated more fully in note cxlv, March 14, 1903.

Though a certain amount of apparatus constructed in accordance with these ideas has already been described, some improvements are of sufficient importance to be



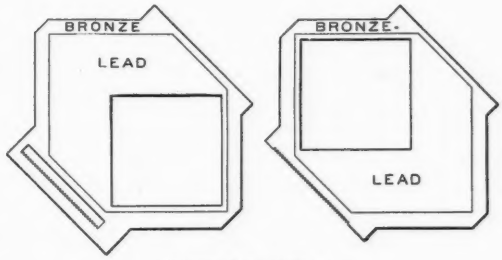
NOTE 149—FIG. 2.—PLAN OF ADJUSTABLE CENTERING DIAPHRAGM; ORIENTER AND ROOS FOR ADJUSTMENT.

considered in the two or three following notes.

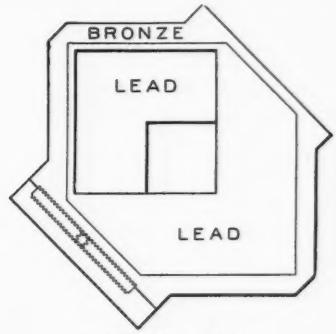
NOTE CXLIX—ON THE FORM OF THE OPENING IN THE DIAPHRAGM PLATE OF THE X-LIGHT TUBE BOX AND ON MEANS OF ADJUSTING THE SIZE OF THE BEAM OF X-LIGHT.

The opening in the diaphragm plate of the X-light tube box should be rectangular for diagnostic and photograph work, because this is the form of the fluorescent screen and photographic plate. If

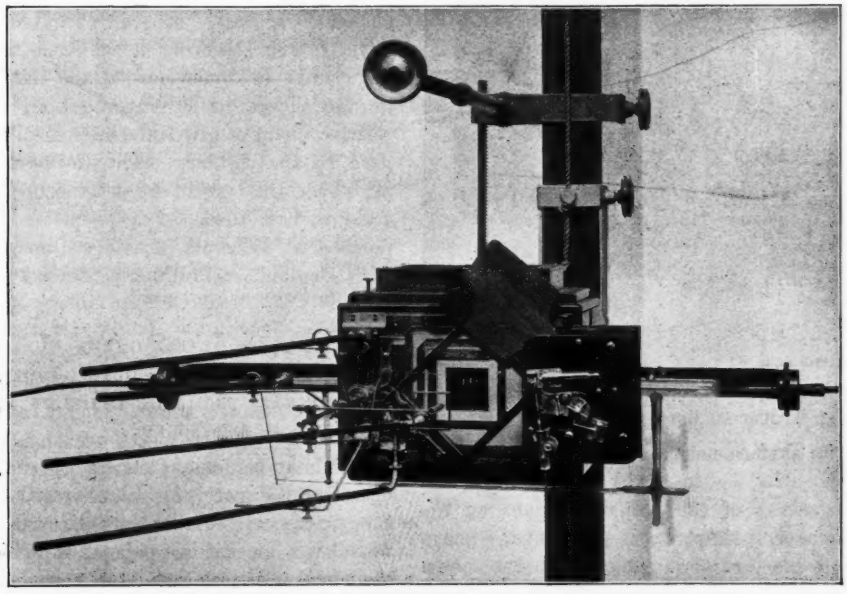
we use a round opening, the section of the cone of X-light escaping from the tube box is a circle (if the cone is cut at right angles to the axis), as shown in Fig. 1. While the patient will be illuminated by the whole cone, it is evident that the only part of the illumination which will be useful, will be that included in the rectangular area of the largest plate or screen—Fig. 1—which can be enclosed by the circle S. All the X-light which strikes the patient outside the rectangular area PS is objectionable, for it is unwise to expose a patient unnecessarily, and the excessive illumination fogs the photographic plate and blurs the image on the screen in two ways. The direct light illuminates the tissues where not needed, the resulting irregularly reflected light in the body helps to conceal the structure of the parts under observation. (Note x, January 5, 1898; note xciv, April 11, 1900.) X-light escaping into a room fills it with a potential mist (note xciv, April 11, 1900) which penetrates to the screen or plate in all directions (*Boston Medical and Surgical Journal,* April 25, 1901), if the ordinary fluoroscope or plate-holders are used. The only way of preventing the resulting diffused illumination from injuring the sharpness of the image on the fluorescent screen or photographic plate is to use the non-radiable cryptoscopes and plate-holders described in earlier notes. Even with these, the injurious effects of the unnecessary light in the direct beam can not be eliminated. Therefore the form of the illuminated area should conform to that of the fluorescent screen or photographic plate. As the proportions of the length and breadth of the ordinary screens and plates are about four to five, the proportions of the opening in the diaphragm plate should bear the same relations to each other. I have, however, in the figures shown a diaphragm plate in which the opening is a square, as I consider the fluorescent screens and photographic plates should have this form, which I recommend to the manufacturers. The principle of the diaphragm plate here shown is as applicable to oblong openings as to squares. If, however, the opening were made longer in one direction than in another, it would be necessary to mount the diaphragm plate on a revolving plate or else to mount the tube box in the same way, either of which complicates the matter. This is another reason for figuring a square opening. To meet the conditions of the first and third axioms, we must be able without removing the eyes from the image on the fluorescent screen to change the size of the opening in the diaphragm plate. As the diaphragm is beyond the reach of the observer, when the tube is placed at the standard distance of one metre, as recommended in these notes, some means of bringing it within reach must be devised. I have designed means of making this and all other adjustments of the tube and light by electric motors controlled by switches on a consol within reach of my hand, in the way employed in my medical rheostats, already described, but such methods are too refined to be accepted at present, therefore all the methods which will be illustrated are mechanical.



NOTE 149—FIG. 3.



NOTE 149—FIG. 4.



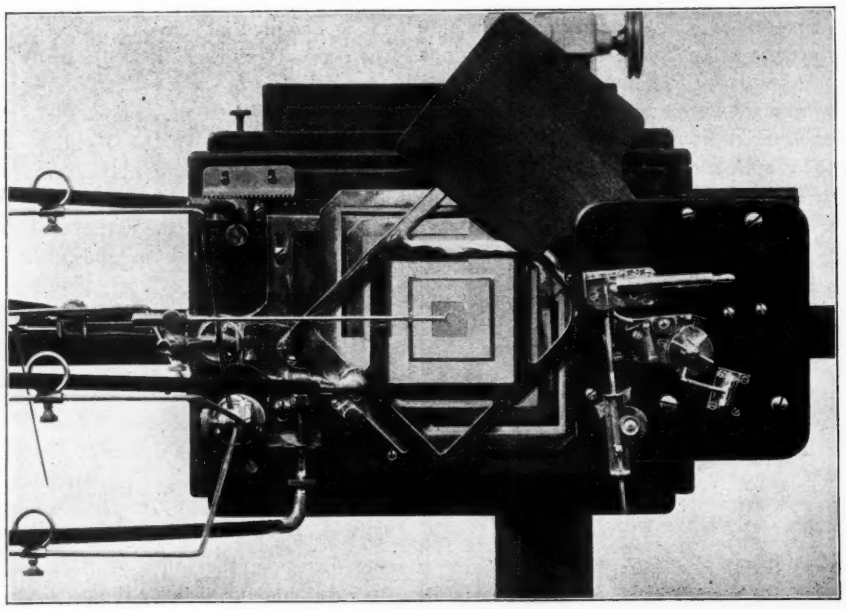
NOTE 149—FIG. 5.

Description of Diaphragm Plate and Adjustment of Size of the Opening—Fig. 2 is a front view of a diaphragm plate attached to the slide S of the tube box TB. The opening of the diaphragm plate when fully expanded, as shown in the figure, has an area of forty-nine square centimetres. By turning the milled head MH the size of the opening can be reduced or the X-light entirely cut off.

Figs. 3 and 4 show the mechanism by which this is accomplished. Each of the diaphragm leaves has a rack R (Fig. 3). When the two leaves are superimposed as in Fig. 4, the pinion P passes through both, and when turned, moves one leaf in one direction, the other in the opposite an equal amount, making the opening and closing symmetrical about a centre. The central portions of the leaves are made of lead plates two or more millimetres in thickness, that the surroundings of the diaphragm opening may be non-radiable.

Method of controlling the opening from a distance: The milled head MH has a square hole in it. Into this hole fits the projection of the spiral spring SP (Fig. 2) of the regulating handle RH. The regulating handle is supported in any position by the adjustable arm AR. Fig. 5 is a perspective view showing the parts in position; Fig. 5A, front view. Method of controlling the position of the diaphragm plate (Fig. 2): A screw S operated by a milled head MH 2 and handle RH 2 supported by the arm AR 2, moves the diaphragm plate transversely to the tube box. Movement at right

angles to this in the same plane is effected by a similar handle RH 3 supported by the arm AR 3 and operating the rack R through the pinion P. By means of these handles, the diaphragm plate can be centered with the central ray so that the opening and closing are symmetrical about this ray, a matter of importance to be spoken of later. As mentioned in earlier notes, the form of the diaphragm opening when the light is used for therapeutic purposes does not require to be a square, as the diseased areas seldom have that form. The round opening may therefore be useful in such cases. To get an easily adjusted round opening, the iris diaphragm may be attached to the diaphragm plate. As, however, a mask is used in such cases, the hole in which only exposes the necessary area of the patient, it is adequate to use the square opening, thus saving the extra cost.



NOTE 149—FIG. 5A.—TUBE BOX WITH ADJUSTABLE, CENTERING DIAPHRAGM; SHUTTER; ORIENTER VACUUM, REGULATOR AND ADJUSTING RODS.

NOTE CL—ON THE FORM OF THE MOUNTING FOR THE CENTRAL RAY MARKER, DISTANCE AND POSITION FINDER, AND ON THE METHOD OF ADJUSTING THEM DURING AN EXAMINATION WITHOUT REMOVING THE EYES FROM THE IMAGE ON THE FLUORESCENT SCREEN.

Axiom 4 stated that the physician must be able to orient himself in relation to the source of light and the patient at all times during the examination without removing his eyes from the image on the fluorescent screen. The apparatus described in notes cxv and cxvii, March 19, 1901, and more fully in note cxliii, March 7, 1903, enables this to be done. An improved form of mounting is here shown. The central ray marker, distance and position finder is permanently attached to the diaphragm plate, following its movements; therefore, as the position of the diaphragm plate is controlled by the handles RH 2 and RH 3 (Figs. 2, 5 and 5A, note cxlix), it is evident that the same handles enable the observer to locate the position of the source of X-light by moving the diaphragm plate until the image of the central ray marker shows as a circle on the screen, as in Fig. 4, note cxliii, and Fig. 6, note cxlix. Then the source of light is under that circle in a direct line (note cxvii, 1901, and note cxliii, 1903). As the diaphragm plate is mounted with the opening concentric to the central ray marker, it is evident that the beam of light is concentrically disposed about the central ray. The method by which the physician is always able to keep the fluorescent screen with its surface normal to the central ray, as it must be to avoid distortion of the shadows of the patient's organs on the screen, is simply to be sure that the image of the central ray marker on the screen is free from distortion and this soon becomes instinctive. Where it is desired to have the tube in a direct line under some selected spot of the body, as recommended by Williams (page 66 of "Rœntgen Rays in Medicine and Surgery"), a lead ring about fourteen millimetres in diameter should be placed either on the patient's skin or clothing over the spot. The image of the central ray marker is then centered with the ring, appearing as a darker and smaller ring inside the image of the lead ring on the fluorescent screen.

NOTE CLI—ON MEASURING THE DISTANCE OF THE X-LIGHT WITHOUT REMOVING THE EYES FROM THE FLUOROSCOPE.

It is often necessary in making a diagnosis with the cryptoscope to vary the distance of the source of X-light without removing the eyes from the image on the fluorescent screen, as, for example, to get a preliminary idea of how far below the surface a foreign body or aneurism is, and to know at any moment the distance of the source of X-light and how much it has been moved to allow the variation in the shadows to give us the information we desire.

If a physician is provided with a tube box mounted, as shown in the figures in these notes, with the central ray marker, distance and position finder[1] attached to the diaphragm plate and controlled as shown, this can be done by mounting a non-radiable scale along one edge of the fluorescent screen. It then is only necessary to move the screen until the image of the central ray marker comes into convenient relations with the scale. The diameter of the image on the screen of the distance finder shows at once the distance of the source of X-light (note cxliii) and by noticing how fast this changes, as the source of X-light changes, and observing at the same time the change in dimensions of the shadow of the object under investigation, the relative changes give information in regard to the distance below the surface at which this object is situated. The scale is best made of a strip of lead notched at intervals of ten millimetres, with smaller, or millimetre, notches between.

NOTE CLII—ON ALTERING THE QUALITY OF X-LIGHT WITHOUT REMOVING THE EYES FROM THE IMAGE ON THE FLUORESCENT SCREEN.

This may be done by means of handles operating the spark-gaps in series with the tube (note cxii) or with a tube such as was shown in earlier papers, in which the Crookes potash regulator was placed in shunt circuit, and operated by heat produced by the same current used to excite the tube; the amount of current passing through the regulator being adjusted by the size of the spark-gap in the regulator circuit. The second is the form of regulation figured here and the novelty of the method consists in altering the spark-gap and, consequently, the character of the light, when the tube is at the standard distance for fluoroscopic exami-

[1] I have applied the name Orienter to these instruments.

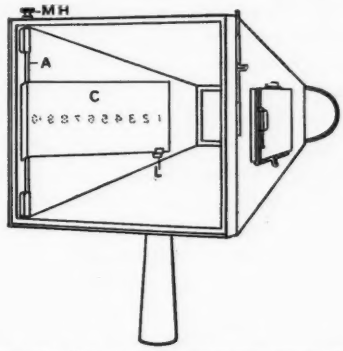
nations, or beyond the reach of the unaided hand. Fig. 5, note cxlix, shows this clearly. A rack is attached to the tube box. This rack bears a wire which slips through a ring in the head of the wire of the spark-gap of the regulator. A pinion controlled by the left-hand handle —RH 4—operates the rack, thus changing the length of the spark-gap of the regulator circuit, which alters the degree of the vacuum and, consequently, the character of the X-light until it is suited for the examination. No fluoroscopic diagnosis is satisfactory unless the quality of the X-light can be controlled without removing the eyes from the image on the fluorescent screen during the whole examination. It is on account of the imperative necessity for such control that I have written so much at different times on this subject. I should like to see fluoroscopic examinations receive the attention which their importance in diagnosis merits.

NOTE CLIII—ON METHODS OF MOUNTING THE ROENTGEN PENETRATION GAUGE.

All gauges in which metals in varying thickness are used to test the intensity of X-light are Rœntgen's, whether they are called Smith's or Jones's. This note is not intended, therefore, to describe a new gauge, but to show convenient methods of mounting an old one. In note cliv a new form of cryptoscope is figured with a mirror inside. I have mounted a penetration gauge, which when not in use acts as a cover for the mirror, Fig. 1. By means of a milled head on the outside the gauge can be turned down between the eyes and the fluorescent screen, Fig. 2. With this construction the gauge is acted on by the X-light, which has passed unchanged through the fluorescent screen and a separate fluorescent screen is mounted on the gauge. Another construction is to mount the gauge on the outside of the cryptoscope with a hinge enabling it to be turned back when not in use. Either method ensures the gauge being at hand when wanted. As diffused light should always be excluded in all photometric work, the rod controlling the size of the opening in the diaphragm plate, Figs. 2, 5, 5A, note cxlix should be turned until the opening of the diaphragm is so small that the penetration gauge more than covers the illuminated area of the fluorescent screen. Pure tin in sheets one one-hundredth of a millimetre in thickness makes a convenient gauge, which might be adopted as a standard, to enable observers to report the penetrating power of the light used, for the benefit of others.

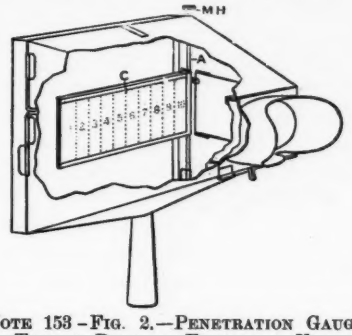
NOTE CLIV—ON KEEPING THE MERCURY PUMP HOT.

I have shown why an X-light tube should be heated during exhaustion. The pump also requires heating, but on looking up the literature I found that the idea was not original, having been advanced by Rood years ago, therefore it was not considered in my notes on pumping. However, as I have not yet seen any



NOTE 153—FIG. 1.—CRYPTOSCOPE WITH PENETRATION GAUGE TURNED BACK AND ACTING AS COVER TO MIRROR.

one who is now using a hot pump, I mention the matter and describe a method of lubricating the stop-cocks, for it will be found on trial that none of the materials in use will answer. All seals must be mercury. The best lubricant I have yet found after a considerable search among inorganic materials is graphite, of the fineness used by electrotypers. To heat the pump it is placed in an oven of wood below the metal oven, described in



NOTE 153 - FIG. 2.—PENETRATION GAUGE TURNED DOWN IN FRONT FOR USE.

earlier notes, for holding the tube during pumping. A few holes must be bored near the top of the pump oven, otherwise the bottom will be much colder than the top. The front of the pump oven should be made of glass that the operation of the pump may be observed.

Commercial Wireless Telegraphy.

The London *Times* of March 30 announces that regular commercial transmission of news by the Marconi system between Cape Cod and Poldhu, in Cornwall, has been undertaken on a contract basis, news to be sent day by day to the *Times*.

Boston Local Section of the American Institute of Electrical Engineers.

The Boston local section of the American Institute of Electrical Engineers held a meeting on Thursday evening, March 26, for the purpose of effecting a permanent organization. There were about 150 present, who showed a very active interest in the matter. It was decided to effect a joint organization with the Massachusetts Institute of Technology electrical society. Mr. C. L. Edgar was elected president, and Mr. R. W. Eaton, local secretary. The executive committee consists of President C. L. Edgar, Dr. Louis Duncan, Mr. C. B. Burleigh, Dr. A. E. Kennelly and Mr. Walsh. Abstracts were read of the car-lighting papers presented at the February meeting of the Institute in New York city, and of the discussion. Mr. J. F. McElroy, of Albany, also presented a special paper upon car lighting.

Philadelphia Section of American Institute of Electrical Engineers.

The next regular meeting of the Philadelphia branch of the American Institute of Electrical Engineers will be held at the Engineers' Club, of Philadelphia, 1122 Girard street, on Monday, April 6, at 8 P. M.

The papers relative to high-tension transmission, presented at the New York meeting of the Institute on March 27, will be presented at this meeting, and discussed.

The meeting promises to be very interesting, as a number of well-known engineers, who are particularly interested in the subject of high-tension transmission, have promised to be present and take part in the discussion.

The Electric Club.

The first annual report of the Electric Club, of Pittsburg, has been issued. This attractive booklet bears the date of March 19, 1903, the anniversary of the club's organization. The report covers about sixty pages, and is artistically arranged and illustrated. The names of the members are listed alphabetically. A feature of the work taken up by the Electric Club during the past year has been the formation of classes for the study of technical subjects, under the instruction of various engineers of the Westinghouse Electric and Manufacturing Company. Besides a well-equipped technical library, there are all the various electrical and mechanical magazines for the research of the members. The club has proved a great success.

Power Transmission on High-Tension Lines.

The One Hundred and Seventy-fourth Meeting of the American Institute of Electrical Engineers, Held at 12 West Thirty-first Street, New York City, Friday, March 27, 1903.

PRESIDENT Charles F. Scott called the meeting to order at 8.20 P. M., and said in part:

"Associate members to the number of 200 were elected this afternoon, and two were elected to full membership from associate membership—Professor B. V. Swenson, assistant professor of electrical engineering in the University of Wisconsin, and Mr. James Swinburne, president of the British Institution of Electrical Engineers. The board of directors has established a membership to be known as 'students of the American Institute of Electrical Engineers.' These students will not be corporate members of the Institute, but this action is intended to bring into touch with the Institute young men, particularly those who are taking college courses. The dues will be low—$3 a year. Such members will be entitled to the monthly announcements and the monthly copies of the transactions, but not to the bound volumes, without additional payment. It is thought this will bring in touch with the Institute a great many young men who will profit thereby, and who will be in training to become formally connected with the Institute later. This is a part of the development of our work with colleges, and is in line with the establishment of local meetings in different colleges, quite a number of such meetings being in operation at the present time.

"The subject of the meeting this evening is 'Power Transmission on High-Tension Lines.' The invention of the steam engine underlies the progress of the nineteenth century. Cheap and abundant mechanical power has been a prime factor in that advancement. The railroad, the steamship, the machine shop, the factory, the rolling mill, the modern printing-press and the mine hoist are developments which are based upon the steam engine. If the coal supply be shut off, the whole mechanism of our modern civilization comes to a standstill. There have been two lines of development, one of the engine for producing power, the other of machines and appliances for utilizing power. On the one hand, the development has been toward engines of large output to secure higher efficiency, and, on the other hand, its load of innumerable tools and machines has sprung up which require power often in small units and sometimes at varying speed. The development of the engine and of the machines for utilizing power has been much more rapid than that of the appliances for transmitting and distributing power from the source to the consumption. All of the various agencies, shafting, belting, and various types of mechanical, pneumatic and hydraulic transmission—the primitive methods of transmission—found their ready limitations in efficiency, in capacity or in distance. It was because it filled this missing link so effectively that the electric motor and electric power distribution have had so phenomenal a development. Electric distribution is so far superior in point of flexibility, efficiency and effectiveness to other methods that it has superseded them, except in the most limited fields. But the transcendent characteristic of electric transmission is its application to long distances. Compared with preceding methods of transmission, the electric distances are infinite.

"Electric transmission in its unique and infinitesimal form has replaced the speaking-tube by the telephone, and has given new possibilities to human speech. So, also, it has given to power development—the vital element in the industrial and commercial progress of the past century—possibilities of a new order. It not only transmits and conveys, but it has made available a new source of power—not beds of stored energy, but waterfalls of wasting energy.

"The relation between distance and voltage is well known. The past ten or a dozen years have witnessed a steady advance in the voltages in commercial use. Additions from the experimental and undeveloped regions of high voltage have been conquered and brought into the domain of commercial service. The line between that which is practicable and that which is indefinite and uncertain has continually advanced. Each increase in voltage introduces new problems, new classes of phenomena are revealed, and difficulties more complex are encountered. Problems in construction and design and installation of apparatus, problems in insulators and line construction, problems in lightning and static protection, problems in switching, controlling and measuring current, have been presented and solved with each advance in voltage. It has not been so many years since 100 or 200 kilowatts to be transmitted twenty or thirty miles at 10,000 volts was considered a somewhat remarkable undertaking.

"The changes from the conditions of ten years ago to those of to-day have been, step by step, along the lines of scientific and engineering progress. The advance has been an evolution. The problems in transmission have been engineering problems; they have been far-reaching problems. Electrical theory, mathematical formulæ, the brilliant inventor, the skillful designer, the careful experimenter and the intelligent operator have all contributed to the continuous solution. One of the prime factors in the advance has been experience and the ability to interpret experience and make it a foundation for further advance. The purpose of the Transmission Committee of the American Institute of Electrical Engineers is to so utilize experience. Mistakes have been made; they have been overcome. Experience has demonstrated what is successful. There is no credit to the electrical engineering profession in reducing the efficiency of electrical enterprise by repeating mistakes. The responsibilities which rest upon the profession call for the most efficient cooperation for the elimination of inadequate methods. We must crystallize, through present practice, that which should be made standard practice. We must make definite the steps already taken and lay the foundation for the future.

"The progress in high-tension transmission is indicated by the transformer statistics of one of the large manufacturing companies. Transformers for 10,000 volts and over have been built during the past twelve years. Units recently built have three times the output of the largest transformers of five years ago. The aggregate output has been over a million kilowatts. The average kilowatt output per month during the past year is equal to the total output during the first seven years. The output of the past two years has exceeded that of the preceding ten years.

"I repeat that the transmission problem is an engineering problem. It is not a simple one. It is difficult; it is comprehensive; it is not a one-man problem, to be solved by some individual with a peculiar scheme; it is a problem for the engineering profession. It is one to which the engineers who operate plants, who use apparatus, as well as those who

invent and design, must contribute. We must cooperate. After we have helped one another all we can, there are still problems which will tax the most able and most active."

Secretary Ralph W. Pope then announced that at the meeting of the board of directors, after the canvass of the nominations, the following ticket had been formulated: For president, B. J. Arnold, of Chicago. C. O. Mailloux was nominated by two of the directors, but his nomination was withdrawn at his personal request. The nominations for vice-presidents are: Calvin W. Rice, W. S. Barstow, Ralph D. Mershon; for managers, Dr. Samuel Sheldon, W. C. L. Eglin, George F. Sever, A. H. Armstrong; for treasurer, George A. Hamilton; for secretary, Ralph W. Pope.

President Scott then called upon Mr. Ralph D. Mershon for the first paper of the evening, which was a contribution to a discussion on "The Mechanical Specifications of a Standard Insulator Pin." These introductions to the discussions were all printed in the ELECTRICAL REVIEW for March 28.

Mr. Mershon stated that he had a number of written contributions to the discussion which take up the various points involved, and read these contributions as a means of opening the discussion on the subject itself. He wished to state, however, that his object in writing his introduction was to get discussions sufficiently full on which to base recommendations to the Standardizing Committee for a standard pin—standard in some respects, at any rate to get a start on the matter. The first was a contribution to the discussion by Mr. H. M. Gerry, Jr., of the Missouri River Power Company, who said:

"It is too early in the development of high-tension transmission to attempt to make standard the details of construction. Such action at this time by the Institute would result not only in failure, but would have a tendency to prevent advancement in this line. However, a full discussion by the membership can not fail to be of great advantage and profit at this time.

"Mr. Mershon has suggested the adoption as standard of certain forms of wooden pins, the designs of which conform to common construction. Most engineers of experience, however, would be in favor of a diameter greater than one inch at the top of the pin, and a greater length of thread than two and one-half inches. Wooden threads most frequently fail by shearing, and the strength in this particular is greatly increased by a larger diameter of pin and a greater length of thread. The longer thread is an advantage, also, in preventing the insulator from tipping out of line, when the fitting is loose between the thread of the pin and that of the insulator.

"The shoulder of the pin, as suggested by Mr. Mershon, has certain disadvantages for heavy construction. On account of the rounding off of the top of the cross-arm, this form of shoulder does not bear well, and the sharp corner at the point of greatest strain introduces an element of weakness. A form of shoulder which has been used by the writer with considerable success tapers at an angle of sixty degrees and fits into a counterbore in the top of the cross-arm. With this design the pins may be driven to a firm bearing at the top of the cross-arm, which has the effect of steadying the pin and increasing the strength of the construction at this point.

"In lieu of the form of thread proposed by Mr. Mershon, the writer suggests a design in which the square top of the thread is as wide as the groove, resulting in increased area of wood to withstand shearing strains. The threads of the insulators are always stronger than those of the pins, and for this reason the form of thread as proposed has considerable advantage. This form of thread may also be easily and readily cut, in either seasoned or unseasoned wood, and the depth not being so great the pin is stronger at the bottom of the thread."

The next contribution was by Mr. William R. C. Corson, electrical engineer, of Hartford, Ct. Mr. Corson said:

"Mr. Mershon's method of developing the table of dimensions of the proposed pin is so rational that criticism of it is difficult. Briefly stated, of course, this method assumes the pin in general use as a basis, and mathematically determines the diameters of pins of different length which shall be capable of sustaining the same tension at their extremity as will this pin. In other words, the safe load that may be applied at the top of the proposed pins is of constant value in all. This value is not discussed in the 'Introduction,' and feeling that its determination would be of interest to me and might prove of value, I have made a series of tests in a Seller's machine to ascertain the value of s in equation 1 for the ordinary locust pins under the actual conditions of support suggested.

"Six standard locust wood pins were selected at random from a supply on hand. The larger diameter of the shank varied from one and seven-sixteenths inches to one and one-half inches, while the smaller diameter was uniformly one and eleven-thirty-seconds inches. These were supported in a one and one-half inch hole in a hard-wood block, and the measured tension applied about four and one-half inches from the block, the exact distance of the point of application being measured.

"The load was very gradually applied in increments of a few pounds and the amount noted when the first separation of the fibre appeared. Most of the specimens showed distress at from 700 to 750 pounds, with maximum strength of about ten per cent above this. One specimen, however, showed a crack at 600 pounds, and an ultimate strength of 1,083 pounds. The average value of s determined from the tension at which the first fibre separation appeared was 11,130 pounds per square inch, and the average value calculated from the maximum loads sustained was 3,623. The value of s calculated for the specimen cracking at 600 pounds was 9,280. While this is somewhat below the average, due to an apparent defect in the wood, it is probably best to assume that for a maximum load s should not be greater than 9,000. Assuming this value, the maximum load that may be applied to the proposed pins at a distance from the cross-arm equal to the designation of size would be as follows:

Size of Pin. Inch.	Value of P.
5	557
7	639
9	615
11	610
13	621
15	694
17	670
19	700

"Of course, these values of P would be identical but for the difference between the actual diameter selected and that of the theoretical pin. The average value is 636 pounds, which may be considered the maximum load which the standard pins will sustain at the point designated.

"Even with very generous factors of safety, it would appear that the pins suggested would prove of ample strength to withstand the side strains to which they may be subjected. For heavy work and for end holes, an insulator carrying the wire at some distance below the top of the pin would, of course, increase the strength of the construction. A table of standard insulators could, perhaps with advantage, be prepared so proportioned between groove and bottom of threaded bore as to maintain the stress on the pin within the allowable safe values for the various tensions applied.

"I would call attention to one seeming

error in the table of the dimensions of the proposed pins. In this paragraph headed 'Designation' the following appears: 'It is proposed to designate that portion of the pin above the cross-arm of the stem of the pin,' and further, 'It is proposed to designate a pin by the length of its stem.' From this definition the stem of the pin would have a length equal to the sum of the dimensions 'A' and 'G' of the table. This would be for the five-inch pin shown in the table five and one-quarter inches, and thus is not equal to the designation."

Another contribution to this discussion was by Mr. C. L. Cory, of San Francisco. Mr. Cory said:

"The mechanical strength of insulator pins for use on long-distance transmission lines has been given much consideration by electrical engineers in California during the past six years. For the most part the insulator pins in use are wood. On the 33,000-volt, eigthy-three-mile, double-circuit, three-phase transmission line of the Edison Electric Company, from its Santa Ana power-house to the city of Los Angeles, iron pins with porcelain sleeves are used, and this transmission is the most notable system in California at the present time using insulator pins other than wood.

"Eucalyptus has been found to be perhaps the best wood to use for insulator pins. After being turned up and threaded, they are usually treated with hot linseed oil. This treatment is desirable more on account of the protection which such treatment gives the pin against weather than on account of the insulating qualities of the oil or oil treatment.

"It should be understood in this connection that an insulator pin should be depended upon only to support the insulator. The insulator in turn should be depended upon to provide the necessary insulation for the line wires. No pin after being in use for a few years on a pole line can maintain to any marked degree the insulating qualities originally existing, due to such oil or paraffin treatment.

"The tests were made in the electrical laboratory of the University of California for the purpose of determining how near the pins generally in use in California conform to the proposed standard pins suggested by Mr. Mershon. In the test twenty-two pins were broken. These were not selected particularly for the test, but were taken at random from a large lot of such pins which were to be used in construction work. Of these, twelve were of the size generally in use on transmission lines where the voltage does not exceed 30,000 volts. These pins are eleven and one-half inches long, including shank and stem, the latter being six and seven-eighths inches in length. The other ten pins tested were of the size used on the lines of what has been known as the Bay Counties' Power Company, now the California Gas and Electric Corporation, and the Standard Electric Company. The line voltage in each of these transmission systems is from 40,000 to 60,000 volts. These pins are fifteen and three-quarter inches long, including shank and stem, the latter being ten and one-eighth inches long.

"These pins do not exactly conform in size or length or stem with any of the proposed standard pins. Below, however, is given the comparative dimensions of the two samples of pins tested and the nearest sizes of the corresponding proposed pins. For sake of comparison, a seven-inch pin, as proposed, is contrasted with a six and seven-eighths inch tested pin, and eleven-inch proposed pin is contrasted with a ten and one-eighth inch tested pin. The above dimensions refer to the length of the stem of the pin as suggested by Mr. Mershon.

"In general the dimensions of the proposed and tested pins agree fairly well. The most marked difference is in the diameter of the portion of the pin which is threaded to receive the insulator. It seems evident that one inch is not a sufficient diameter for the thread of the pin for all sizes. If there is any burning of the pin just below the insulator, the inevitable result will be the breaking of the pin at the bottom portion of the thread. Such a break will usually leave the pin, except the threaded portion, standing in the cross-arm, while the insulator, with the threaded portion of the pin inside, will hang suspended on the line wire. This sort of break has often been observed on high-voltage transmission lines.

"The average results, referring to the 'real breaking load' of the tests of the two pins, are, respectively, 1,085 pounds for the six and seven-eighths inch pin, and 2,310 pounds for the ten and one-eighth inch pin. The character of breaks in the two pins, however, is not the same. Almost without exception the six and seven-eighths inch pins were broken approximately square off at the cross-arm. The larger pins, however, split in the stem, the beginning of the split being just at the bottom of the thread.

"It seems from the tests that the shank is the weakest part in the six and seven-eighths inch pins, while the stem, and particularly the upper portion of the stem or thread, is the weakest part of the ten and one-eighth inch pins.

"The variation of the 'real breaking load' for the different six and seven-eighths inch pins tested is from 705 pounds minimum to 1,360 pounds maximum. For the ten and one-eighth inch pins this variation is from 1,475 pounds minimum to 3,190 pounds maximum.

"During the progress of the test it was observed that the allowable 'breaking load' was least when the pin was turned in the cross-arm so that the strain was across the grain of the pin, while the greatest allowable 'breaking load' corresponded with the position of the pin in the cross-arm, so that the strain was parallel to the grain of the pin. In the tests, as made, no particular care was taken to turn the pins in any fixed position relative to the grain of the pin and the direction of the strain applied.

"For good construction on lines using 30,000 to 60,000 volts, a larger pin must be used. It does not seem, however, that any good reason exists for a great number of different sizes of pins, as it would seem probable that the two sizes tested might be used to fulfill almost every requirement for transmission work where wooden pins are at all allowable.

"In many respects an iron pin is better than one of wood. In the first place, to secure sufficient strength in the shank, the wooden pin must be of such a large diameter that the size of the cross-arm is necessarily increased. In addition, using an iron pin, the insulator can be held down on poles or supports, where the tendency of the line wire is to raise or pull the pin out of the cross-arm. In using wooden pins, this is usually prevented by driving a nail through the cross-arm into the shank of the pin.

"An iron insulator pin, possessing many desirable features, has been designed for use on the extensive transmission lines of the Vancouver Power Company, of Vancouver, British Columbia, the design being due to Mr. Wynn Meredith, of San Francisco. In general, the pin consists of a steel bolt, approximately twelve inches long. A cast-iron sleeve, four and one-quarter inches long and fitting closely to the cross-arm, fills the space between the thread and corresponds to the stem of the ordinary wooden pin. The thread of the pin is made of lead, this lead thread being cast upon the end of the steel bolt, the steel bolt first being chopped or made ragged, so that the lead is held firmly to the steel bolt after being

cast. The tests upon this form of pin have not as yet been completed, but as soon as possible the results will be presented to the Institute."

The fourth and last contribution to this part of the subject was by Mr. D. L. Huntington, electrical engineer of the Washington Power Company, Spokane, Wash. Mr. Huntington writes as follows:

"Wooden pins are subject to so many uncertainties where used in connection with very high voltages, especially where the atmosphere contains salt, smoke or dust, that it seems desirable to abandon their use for such purposes, wherever possible, and to substitute a metallic pin. The construction of a long-distance line for 60,000 volts led the writer to make some investigation as to what could be done in this direction without excessive cost.

"It was decided that a drop-forged or a turned steel pin would be so expensive as to exclude either, even if the time at our disposal would have permitted.

"Experiments were made with cast-iron pins almost identical in dimensions to that shown in Fig. 2 of Mr. Chesney's paper, except that it was cored out internally so as to make its weight about ten pounds. The diameter of the shank was two and one-eighth inches. This pin sustained a load slightly in excess of 3,000 pounds, suspended from near the end of the threaded portion, before fracturing. Fear was felt, however, as to what might occur under the sudden strain of a line parting in winter time, with the possibility of the fracture of several pins at a time due to the sudden shock.

"To avoid this, several designs were made of pins cut from round steel bars of one inch and one and one-eighth inches in diameter. The difficulty in securing a satisfactory shoulder for the pin at the cross-arm proved serious. Furthermore, it was feared that with a pin of that small diameter the cross-arm would be likely to burn out at the pin hole, as the interior surface of the hole would be comparatively small for distributing the leakage currents to the cross-arm. Moreover, actual experience with wooden pins has shown more or less conclusively that with a shank diameter of two inches or greater there is little or nothing to fear from this trouble.

"As a result of these several difficulties, we have designed and adopted a pin eighteen inches long, made of one and one-eighth inch round milled steel bar, and having a shoulder and a shank cast upon it, as shown. This pin, we find, will begin to bend when loaded with about 1,000 pounds at the upper end—the shank being rigidly supported. This is much lower than the results obtained by the cast-iron pin referred to above, but it is believed that it is more reliable and that it is sufficient for nearly all ordinary work. In addition, the steel bar will not snap off under sudden shock, but will support the insulator and line safely even when badly bent.

"We were unable, in the time at our disposal, to investigate what could be done in the way of malleable castings of a design somewhat similar to the cast-iron pin mentioned above, but it is the writer's opinion that it would prove a fruitful line of investigation.

"High freight rates in the West and a higher initial cost will doubtless make some of those in charge of the construction of such lines hesitate at the extra expenditure (in our case it was about double the cost of eucalyptus pins), but it is in the line of safe and conservative engineering, and certainly strengthens the weakest link in our high-voltage chain—our lines."

Mr. Percy H. Thomas, of New York, said it would be a great gain to those who hope to get information from the report of the committee if the characteristics of the different types of wood to be used could be discussed—oak, eucalyptus and locust.

The contributions to the discussion of Mr. F. O. Blackwell's paper on "The Testing of Insulators" were then read. The first contribution was from Mr. M. H. Gerry, Jr., who said there could be no complete set of tests to determine the design, shape, material and dimensions best suited for a given voltage, as it was not only a matter of experiment, but of skill and judgment in properly interpreting the results of many tests in relation to service conditions. For glass insulators it is usually sufficient to inspect them for physical defects, such as cracks, bubbles and incorrect dimensions. A certain percentage of the insulators should also be tested for proper annealing and for mechanical strength. A chemical analysis of the glass of a few of the insulators is also desirable. Electrical tests of glass insulators are unnecessary, as the physical inspection will reveal everything that can be found by an electrical test. Porcelain insulators are more difficult to test than are glass insulators on account of many defects being covered by the glaze. For very high voltage, porcelain insulators should be tested electrically and should also be carefully inspected during the process of manufacture, and before the glaze is applied. This is especially desirable with insulators built up of several parts and cemented together by glaze or other material. Defects in insulators of this type are difficult to detect, even by electrical tests, unless they are in pronounced degree.

Mr. Mershon said that between glass and porcelain, it seemed to him, that about the only advantage, other things being equal, that porcelain has over glass for transmission work is that of mechanical strength. Sometimes it has that advantage and sometimes it has not. It is a fact, however, that in some forms of insulator—in some complex forms—it is possible to get the porcelain insulator cheaper than the glass one. He found that to be the status in one or two cases. When the insulator is large, so that it takes the form of a very heavy central portion of glass, with long, thin petticoats, it seems to be almost impossible to make it of glass and have it symmetrical. The thinner portions cool first, and the insulator is taken from the mould and the weight of the outer portions distorts the inner portion of the insulator, which is still hot. An advantage has also been claimed for porcelain over glass, because of the lesser hygroscopic effects on the porcelain insulator, but he thought in most power transmissions the small amount of power necessary to dry up whatever moisture will get on the surface of the insulator in that way would not be serious and you could not tell the difference. As a matter of fact, the losses of insulators from high voltages show practically no difference that could be detected between glass and porcelain in any measurements that he had made.

A contribution from Mr. W. L. Waters, of Milwaukee, Wis., was then read.

"The form of potential wave given by modern alternators differs very much from a sine wave. The worst case commonly met with is that of a three-phase alternator wound for high voltages. These machines have usually three slots per pole, and the wave form shows pronounced harmonics of five and seven times the fundamental frequency, but the effect of this distortion on breakdown voltage of an insulator is inappreciable. The only commercial machines which have wave forms which would affect the accuracy of the results to any extent are the old single-phase revolving armature machines with projecting poles on the armature, which show a pronounced third harmonic. But these machines are seldom met with now. The charging current in a test on insulators or an overhead line generally con-

forms more or less to the potential wave form of the alternator, and whether the current is lagging or leading, the distorting effect on the wave form is slight, and with all ordinary excitation and loads on the alternator the effect on the insulator test will be inappreciable.

"Generally speaking, an insulating example will stand momentarily a voltage strain which, if continued long enough, will break it down; and this time effect is most marked in solid insulators. A gas, such as air, does not show this. When air is going to break down under a given strain it will do so almost as soon as it is applied, except where the insulation of the air is subsequently weakened by a violent brush discharge. Solids show this effect to the greatest extent, and liquids, such as oil, to a lesser extent. And I have found that in insulating materials where this effect is most marked, differences in wave form have little effect upon the breakdown voltage; it seems to be the mean voltage or possibly the R. M. S. voltage which decides the breakdown. In air the wave form has quite an appreciable effect, and the difference between a peaked wave and a flat wave may be as much as twenty per cent of the sparking distance. Porcelain insulators show very markedly this time effect; they will stand a much higher potential if applied instantaneously than they will if applied continuously, and as far as can be seen from the experiments I have made, they appear to conform with the rule mentioned above and are practically unaffected by wave form. The sparking distance in air, on the other hand, being considerably affected by wave form, shows at once the unsuitableness of using a spark-gap as a voltmeter if there is any doubt about the wave form. And I have found that unless in the hands of a very careful and experienced man, a spark-gap was not of very much use in accurate work. Using needles as electrodes, the voltage seems to vary so much with the conditions of the points, the state of the atmosphere, the proximity of other high-tension conductors, etc., that consistent results can not be obtained in ordinary work. Using amalgamated brass balls, one inch in diameter, gave better results, but they are far from satisfactory. I think there is only one really satisfactory way of measuring high voltages, and that is, by means of a voltmeter transformer connected straight across the insulator being tested. This method is accurate and is direct reading, and there is no chance of mistake and no continual trouble fixing and adjusting your spark-gap. Reliable voltmeter transformers can be made for all ordinary voltages for a few hundred dollars, and the use of one would save its cost in worry and hard work in a very short time.

"The above remarks are strictly only applicable to voltages up to 50,000, as I have had no experience with higher voltages. But I think that with slight changes they will apply to the highest voltages at present in use."

Mr. P. Lincoln then read his introduction entitled "Transportation and Relative Location of Power and Telephone Wires," and the following contribution by Mr. H. M. Gerry, Jr., was read:

"Mr. Lincoln has discussed the most important requirements of telephone construction in connection with high-tension transmission lines. There is no especial difficulty in installing a successful telephone circuit, which will give satisfactory service and reasonable safety in operation, on a pole line carrying from 50,000 to 60,000 volts.

"In regard to transposition: Mr. Lincoln advocates the transposition of the telephone wires only, but it is desirable also to transpose the main power circuits in order to reduce to a minimum the voltage to ground on the telephone circuits. But few transpositions of the power circuit are required, and the service as a rule is materially improved thereby. Where there is considerable lightning, arresters should be installed on the telephone circuits, of a design similar to those used on lightning circuits. The ordinary telephone lightning arrester is an undesirable and unsafe piece of apparatus for this purpose." The writer presented a sketch of the telephone arrangement devised by him, which gave excellent results in service. Especial attention was called to the short gaps across the line, to the location of the lightning arresters, and to the repeating coils, which should be insulated for at least 5,000 volts, and may be immersed in small glass jars containing transformer oil.

"The Missouri River Power Company, with which the writer is connected, regularly maintains a very satisfactory telephone service on its 50,000-volt transmission lines between Cañon Ferry and Butte, a distance of sixty-four miles, and this service is rarely interrupted, even during the most severe lightning disturbance. Under normal conditions there is no potential on this telephone line, and only the slightest hum can be detected."

Mr. Lincoln—There is one point upon which possibly my discussion is not quite clear, and that is in regard to the transposition of the power circuits. I have stated that it is not of very great importance. My reason possibly is not very clear in the paper, and it is this—a telephone line ought to be so made that it will at all times operate, even if one leg of the power line is dead-grounded. If it is made to operate under these conditions, it will operate under the normal conditions of an untransposed power line, because the normal static potential induced in the telephone line by an untransposed power line is vastly less than that which will be induced in the telephone line by grounding the power line, so that if the telephone line is installed so as to run under grounded conditions, that is, with the power line grounded, it will certainly run with an untransposed power line.

Mr. P. H. Thomas suggested that it is possible to insulate the telephone wires, perhaps for 30,000 or 40,000 volts in an extreme case, and at the end of the line put the primary of a transformer and from the telephone the secondary, making very high insulation between the primary and secondary. Thus it would be possible to protect the operator, and since static disturbances do not induce potential between the two wires, it should not disturb the speech. The same result may possibly be accomplished with condensers, by connecting two condensers in series between the two pairs of wires and putting the telephone in between the condensers, not connected with the line. In this case it will probably be necessary to put a choke coil between the condensers and ground its middle point. The charging current of the condensers will be neutralized by going through two halves of the coil in opposite directions, and a telephone winding could be taken from the same core. By preventing the telephone line from reaching a high potential, a practical solution may be obtained, and this method should be tried.

Mr. Chesney presented his paper on "Burning of Wooden Pins on High-Tension Transmission Lines," and read a contribution by Mr. M. H. Gerry, Jr.

Mr. H. W. Buck, Niagara Falls—In regard to the point which Mr. Chesney spoke of regarding the "digesting the thread of the pin," I found many pins on the Niagara transmission where disintegration had occurred at the top of the pin, and it would crumble into white powder. We recently had some of the powder analyzed by chemists, and they found it to be nitrate salt, which would look as if nitric acid was found in the static discharge of the pin and had attacked the wood, forming a combination of nitrogen salt. In this connection I want to say that about six months ago we built an experimental single-phase line about two miles in length, which we

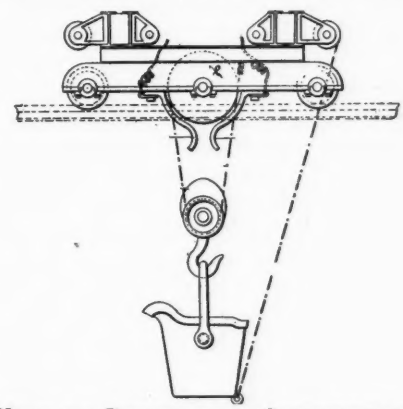
operated for five months at 75,000 volts. The conducting wires of the line were iron, tied with copper tie wires. At the end of the five months' test, the galvanized iron had turned black, although the iron guy wires remained in their original bright condition, so that the blacking of the wires was not due to atmospheric conditions. We took down the wire and noticed it was disintegrated on the surface to the depth of several thousandths of an inch. The copper tie wire was digested to a certain depth, though not as much as the iron, which also looks as if a nitrogen compound was forming in a thin film around the conductor at this high voltage, due to brush discharge, and attacking the metal. This indicates some trouble may be experienced when high voltages are used, on account of the formation of a salt due to the well-known action of nitrogen and oxygen in static discharge, thus forming nitric acid with the moisture of the atmosphere and the compound attacking the metal conductor.

Mr. Carl de Muralt—It may possibly be interesting to you to know that while the general practice in America is to use wooden pins, in Europe it is just the opposite, and practically all the high-potential installations use iron pins; and more than that, while here very often the whole pole is treated with as little iron as possible, in Europe there are quite frequently poles constructed entirely of iron, with iron pins, and the only insulation relied upon is the insulation proper. I believe this does away with the burning of pins, cross-arms and poles. I do not think there is very much difficulty in the way of avoiding mechanical strains, which have been alluded to several times to-night—with regard to the insulator pin, a way to get around that is to fix the pin into the insulator by means of a cement which will take up any such strain, and in a great many installations that I know of cement made of a mixture of litharge and glycerine has been used with, as far as I know, very good results. It seems to me that it is a very good scheme to lay the entire insulation into the insulator, and then let the rest of the pole take care of itself. I know of one installation, in fact two, where they are operated at 26,000 volts, using American glass insulators, and iron pins and iron poles; and another one which is using 25,000 volts, and has porcelain insulators, I believe of a German make, but of a type very similar to the type brought out by Mr. Locke in this country, and using iron pins on wooden poles part of the way, and iron pins in walls and on any kind of a support on the other portion of the road. Both of these installations have not given any trouble whatever, and they are among some of the best high-voltage installations in Europe, so that I think that may be taken as representing pretty good practice.

Professor W. S. Franklin then read his paper and exhibited a model in regard to the distribution of electromotive force and current along a single-phase alternating-current transmission line, after which the meeting adjourned.

Electrical Patents.

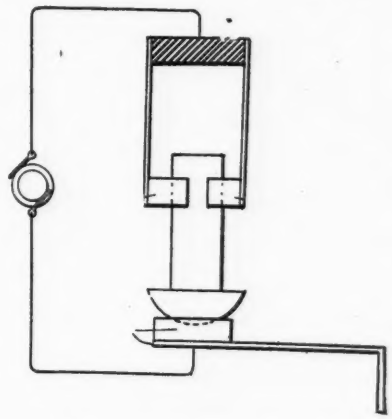
An improvement of an important nature in electric cranes has been devised by Mr. George Mitchell, of Naco, Ariz. This resides in means for preventing the overwinding of the hoist-chains of cranes. The crane is of substantially the usual construction, comprising a hoisting-drum and its motor. In addition thereto a chain and block or sheave is employed. The elements are combined with an electric circuit, including the motor, and means controlled by this sheave or block are employed for automatically opening the motor circuit, when the sheave rises to a predetermined height. In the specific construction preferably employed, the hoisting tackle is the same usually employed, the hoist-chain carrying a pulley block upon which the carrying wheel is swiveled. The motor which operates the winding-drum is included in a multi-



MEANS FOR PREVENTING THE OVERWINDING OF HOIST-CHAINS OF CRANES.

ple arc circuit. In order to prevent the block or sheave from rising high enough to engage the winding-drum and thus endanger the apparatus, it is desirable that the motor shall be stopped automatically before such position is reached. For this purpose the inventor places a fuse in the multiple arc branch in series with the motor, so that by short-circuiting the motor the multiple arc circuit will be opened by the blowing of the fuse. For this purpose spaced contact arms are arranged on the trolley directly beneath the drum and in the line movement of the pulley block, these arms being connected with the motor circuit between the motor and the fuse box. The pulley block constitutes the circuit closure, and thus should it rise sufficiently high it will enter between the arms and contacting therewith close the circuit, consequently short-circuiting the motor and blowing the fuse.

The Westinghouse Electric and Manufacturing Company has just obtained control of a series of patents issued on means for and methods of heating rivets. The inventions are grounded upon the idea that a rivet, to be thoroughly effec-



METHOD OF HEATING RIVETS.

tive, should, after it is upset as completely as possible, fill its grip—that is, the hole or holes in the plate or plates in which it is placed—and in order to accomplish this the point of the rivet should be heated to a less degree than the intermediate portion, so that when pressure or blows are applied to it, that portion which is enclosed by the plates will first be upset. The inventor of the method is Mr. Henrik V. Loss, of Philadelphia, Pa., and in carrying the invention into practice he employs a clamp that is adapted to engage an intermediate portion of the shank of the rivet, this clamp forming or being connected to one pole of a source of suitable electric energy. A support or contact for holding the rivet at or near its head is also employed, and this constitutes or is connected with the other pole of the source of electric energy. As a result, a current passed from the clamp through the rivet to the support, or *vice versa*, heats to a very high degree that portion of the rivet which it traverses, but leaves the other points comparatively cool. The relative positions of the poles with the shank and the head of the rivet determine the amount of unevenness in temperature throughout the length of the rivet, and, by the described method, the rivet may be heated in the holes to be filled or previously to being placed therein. Several patents have been granted on the specific machines for performing the method, which has also been patented in its broadest aspect.

Rapid Gains in Advertising Patronage.

[*From the Fourth Estate.*]

The ELECTRICAL REVIEW, of which Charles W. Price is the publisher, seems to be making rapid gains in advertising patronage, and has just adopted a new dress of type.

Reviews of Current Engineering and Scientific Literature.

Nernst Lamp Tests.

This is a communication from Mr. J. Stottner, giving the results of some life tests of the Nernst lamp, which he believes show better results than those conducted last year by the Physikalisch-Technische Reichsanstalt, which results were reported in the ELECTRICAL REVIEW, July 26, 1902. The results to which the author here refers were made by the Electrical Standardizing Testing and Training Institute, of London. Ten lamps are reported upon, and the number of hours during which each burned is given, but no figures are mentioned for the consumption of energy. The following is a substance of the report:

Lamp No.	Hours.	Cause of Failure.
16	926	Filament broken.
17	716	Filament broken.
18	1,000	Still burning.
19	574	Connection to filament broken.
20	50	Heating coil broken.
21	176	No apparent cause.
22	500	Filament broken.
23	470	Filament broken.
25	95	No apparent cause.
26	1,000	Still burning.

The author believes that these lamps, which are of the German type, will not undergo alteration. The only part which might undergo alteration and improvement would be the burner, and undoubtedly the new burners will be suitable for use in the old holders.—*Abstracted from the Electrician (London), March 13.*

A Magnetic Apparatus for Detecting Electric Waves.

In his recent tests, Marconi has used a detector of electric waves entirely different from the usual coherer. The phenomena made use of are similar to those already noticed by Lord Rayleigh, and studied more recently by Miss Brooks; that is, the permanent demagnetization of a steel core magnetized to saturation, under the action of currents of high frequency or of electric waves. Rutherford's arrangement of apparatus consisted of a steel needle magnetized to saturation and placed within a coil of wire which was subjected to the electric waves. The magnetic changes of the needle were traced with a magnetometer. Monsieur M. Tissot has used a similar arrangement, but replaced the magnetometer by the needle of a Thompson galvanometer. Tissot's researches were undertaken to study phenomena which took place within the receiving antenna of a wireless signaling system. These effects can not be studied by a coherer, because the indications of the latter are difficult to interpret, although it is very sensitive. M. Tissot states that Marconi's receiver is a modification of Rutherford's arrangement, but Marconi noticed that a quick temporary change in the value of the induction of the core took place at that moment when it was affected by the action of an electric wave. It is said that this apparatus can be made as sensitive as the ordinary coherer.—*Translated and abstracted from the Revue pratique de L'Electricite (Paris), March 5.*

A Method of Measuring Heavy Alternating Currents.

The subject was introduced by Monsieur P. Janet, who points out the difficulties met with in measuring heavy alternating currents. With currents up to 600 amperes the Kelvin balance gives very satisfactory and accurate measurements, but for values beyond this the Kelvin balance is not accurate. Results of tests are given, showing the variations which are due to the unequal distribution of current in the heavy conductors of the balance. To overcome this difficulty, it was determined to make a thorough study of a transformer which could be used to reduce the current to a more convenient value. This was done by Monsieur M. Iliovici, who gives here a very complete theoretical investigation, and results of experiments upon simple transformers. The effect of resistance, number of turns of wire in coil, variation in the inductance and in the cross-section of the iron coil, were all studied thoroughly and results are given. It was found by this work that a simple light transformer, weighing about 2.1 kilogrammes and having 250 turns in the secondary, would work satisfactorily. It is not difficult to so wind the transformer as to give a simple current ratio. It is most important to make negligible the effect of Foucault currents and hysteresis losses. A formula is given for calculating transformers for measuring currents of any value.—*Translated and abstracted from Bulletin Société Internationale des Electriciens (Paris), February.*

A Damped Ballastic Galvanometer.

The theory of the ballastic galvanometer, as usually presented, assumes either that there is no damping or that it is small, consequently, there is a general impression that a damped ballastic galvanometer can not be used to measure or compare quantities of electricity. It has been shown, however, experimentally, that such a galvanometer can be used, and when thus used, no appreciable errors have been detected, but results obtained in this way have not been exempted from criticism. Theoretically, damped ballast galvanometers may be divided into two classes—one where the motion is vibratory or periodic, the other where the motion is aperiodic. The theory of the latter class is here given by Mr. O. M. Stewart. The general equation of the motion of the vibrating system contains three terms; one involving the moment of inertia; another, the moment of the damping force, and the third, the moment of the force of restitution. The author discusses this equation and shows under what conditions the motion is aperiodic and periodic. He shows that when the motion is aperiodic the deflection is directed proportional to the quantity, and therefore conforms to the general rule of undamped ballastic galvanometers, no matter how large the damping is. In this discussion the assumption has been made that the damping force is directed proportionately to the velocity. This is true if the damping is due to induced currents and is approximately true if due to air resistance. It is also assumed that the force of the restitution is proportioned to the angular deflection. He discusses the use of D'Arsonval galvanometers used for this purpose, and shows that when the damping has been increased so that the moving part does not spring past the zero position, the deflection is about thirty-seven per cent of what it would have been had there been no damping. Experimental results are given of a Weston milliammeter used for this purpose. The results plotted in terms of the throw and the current flowing in the primary of the induction coil which was used in this work, give a straight line. Tests were made by different observers to determine the accuracy of this instrument, the results agreeing very satisfactorily. The drawbacks to the use of damped galvanometer are its decreased sensibility and that its figure merit can not be computed. In most cases, the latter is not used and the deflections may be made sufficiently great for accuracy. In general, damped

galvanometers are more convenient than undamped.—*Abstracted from the Physical Review (New York), March.*

The Romanoff Suspended Electric Railways.

This is a brief illustrated description of a short length of electric suspended railway, erected recently for the Emperor of Russia. The line is 700 yards in length and runs from the palace to the Gatchine railway station. The cars are suspended from the rail in such a way that they can not leave it without the breakage of several parts simultaneously. The permanent way consists of girders cross-joined, holding the rail, strengthened by an iron belt serving as a foundation for the rail. The steepest incline is 0.18 and the sharpest curve is thirty-five-foot radius. It is said that the weight of the structure need be but seventy-five tons per mile for military purposes, but should be from 260 to 400 tons per mile for passenger purposes. The inventor proposes four systems of railway. The main line for heavy traffic and high speeds of 120 miles; elevated lines for city work; light portable railways for military or industrial work and light railway for express and letter service, the cars traveling at a speed of 150 miles per hour. Estimates have been made for a railway of this character from St. Petersburg to Moscow, 345 miles, with sixty-six trains traveling simultaneously at a speed of about 100 miles per hour. This estimate includes the cost of structure, block signal system, cars, shops, generating stations, etc., and amounts to $119,000 per mile.—*Abstracted from Electrical Review (London), March* 13.

Notes on Commutator Design.

In designing a commutator, two electrical conditions must be satisfied. The energy loss on the commutator must not be great enough to cause excessive temperature rise, and the energy wasted, being all produced by the brushes, must not be great enough to cause undue local heating of the brushes. The most common figure of the current density in commutative design is 33.3 amperes per square inch of contact surface for carbon brushes, but it is believed that this figure may be surpassed without danger if suitable brushes are provided and sufficient care is given to the design of the commutator, and densities as high as 120 used. The allowable temperature rise is, in many cases, limited to seventy degrees Fahrenheit, but since there is no part of the commutator which is easily damaged by heat, this figure might be increased to 100 degrees Fahrenheit. The heat which can be radiated from the commutator depends upon its speed and the area and efficiency of its radiating surface. It is well to reckon only the rubbing surface of the commutator as radiating surface, and a radiation of two watts per square inch at a peripheral speed of 2,000 feet per minute, and three watts per square inch at 3,000 feet per minute, may be allowed. Interior ventilation has been tried, but abandoned because of trouble arising from dirt collecting in the air passages. The loss taking place at the commutator may be computed by measuring the fall of potential between brush and commutator, multiplying this by the current flowing and number of brushes. This gives the joule loss. The friction loss depends upon the pressure of the brushes and the peripheral speed. The coefficient friction varies but slightly with the grade of carbon and may be taken as 0.3. Mechanical details are next discussed. Different types of commutator segments are described and criticised and methods of assembling and insulating are considered.—*Abstracted from the Electrical Engineer (London), March* 13.

Reduction of Armature Reaction.

In this article, M. A. Spilberg discusses the cost of the armature reaction in dynamos and the losses due to this effect. The lead of the brushes necessary for sparkless commutation renders useless certain of the armature coils, and as these conduct the armature current, there is a loss of potential and energy due to their resistance. He suggests the use of two brushes in place of one, these to be separated by an angle sufficient to span the useless coils, and each to collect and commutate the current on one side of the armature. The two brushes are to be connected together and so adjusted that there will be a balance between the electromotive forces set up in the coils between them, and, therefore, there will be no current flowing in the short-circuited section of the armature. Suppressing the current in these coils will decrease the back-turns on the armature, and, therefore, the angle of lead, and, at the same time, will cause less loss in the machine and give each coil as it passes through this part of its revolution a chance to cool. He discusses the practical application of his method. It is necessary that the winding of the armature contain an even number of coils, and that the pairs of brushes be so arranged that the angle between them can be adjusted at will. This may be done by mounting the leading brushes by one rocker-arm and the trailing brushes on another, the two rocker-arms to be connected by means of some adjusting device. They can then be shifted relatively to each other, and, as a whole, relatively into the armature. To suppress sparking, four points must be considered—the action as each coil approaches and leaves each brush. Considering the action at the trailing brush first, as a commutator segment approaches this brush, if no current is flowing in the windings attached to it, there will be no spark when the segment touches the brush. Sparking will be avoided as the segment leaves the brush, if the coil short-circuited by this brush lies in a field of sufficient strength to set up a current in it equal to the current which it will have when the segment leaves the brush. At the leading brush there will be no spark as the segment approaches, and sparking may be avoided as each segment leaves the brush by setting the pairs of brushes in such a position that the resultant electromotive force set up in the coils, short-circuited by the two brushes, is sufficient to stop the flow of current at the moment of break. In practice, the correct setting of the brushes may be determined by connecting a dynamometer to the two brushes of a pair, or simply by adjusting for sparkless commutation.—*Abstracted from L'Electricien (Paris), March* 14.

The National Physical Laboratory, London.

At a recent meeting of the graduates at the Institution of Mechanical Engineers, Dr. R. T. Glazebrook gave a description of the Physical Laboratory, of which he is in charge. The laboratory is provided for carrying out engineering research work and has equipped rooms for thermometric work, metallurgical studies and tests of materials. The work of the laboratory will include routine test work, original investigations, undertaken at the initiation of the committee in charge, and enquiries and experiments made at the request of engineers and others and for which fees are received.

The List of Books in the Wheeler Gift.

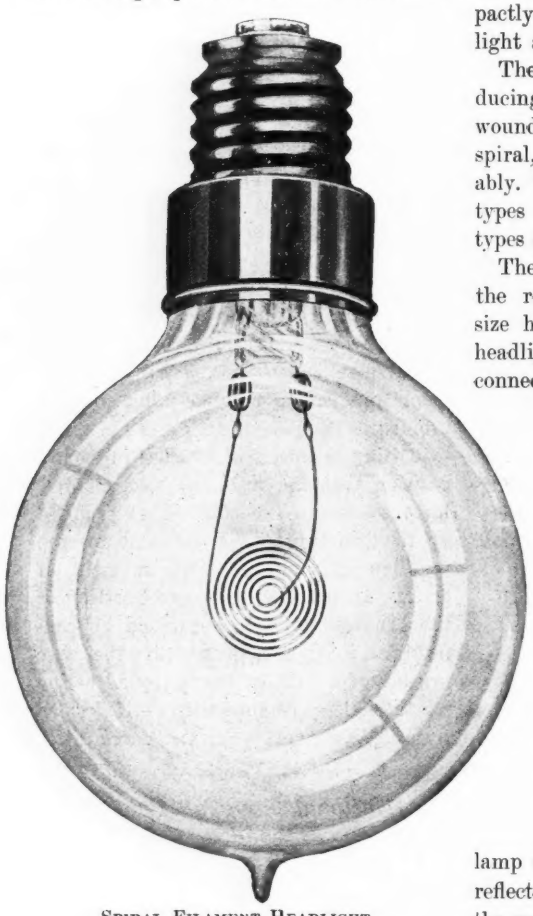
The list of books and pamphlets in the gift of Dr. Schuyler S. Wheeler, which have been published prior to 1826, is given in the February number of the transactions of the American Institute of Electrical Engineers.

INDUSTRIAL SECTION.

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS.

Incandescent Lamps for Street-Car Headlights.

With the growth of urban trolley lines and the high speeds of modern street railway service, effective headlights are a necessity. To be effective for such a service, a headlight must throw a brilliant path of light for a distance of at least 100 feet ahead of the car.



SPIRAL FILAMENT HEADLIGHT.

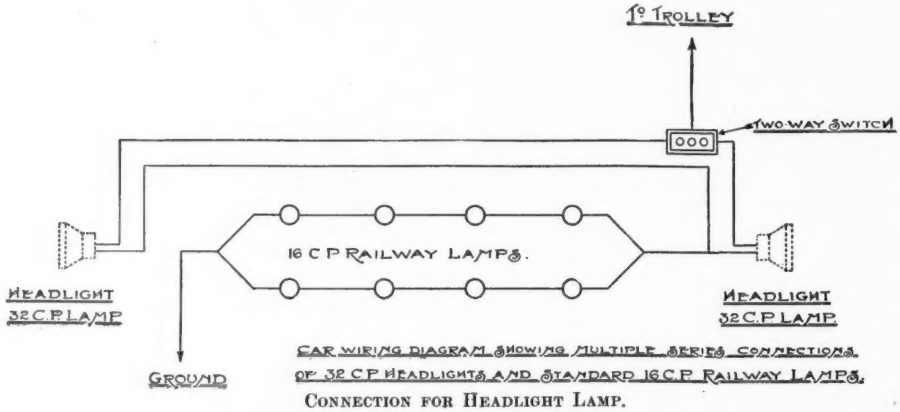
A parabolic reflector is the type desired for projecting the light. For good service with such a reflector, the filament of the incandescent lamp should be compactly formed so as to concentrate the light as far as possible at a point.

The General Electric Company is producing a lamp with a special filament, wound in the form of a close conical spiral, which serves the purpose admirably. This filament is supplied in several types of bulbs made to fit the various types of headlights.

The standard type of headlight lamp is the round bulb thirty-two-candle-power size here illustrated. This requires the headlights to be wired in multiple series connection, with two circuits, each of four sixteen-candle-power lamps. The wiring connections are clearly illustrated in the accompanying diagram. For conditions which do not permit using a thirty-two-candle-power lamp, the General Electric Company can supply a sixteen-candle-power lamp with conical spiral filament.

Every endeavor, however, should be made to use the thirty-two-candle-power lamp, as anything less does not give a sufficient volume of light for a good headlight service.

To give the best results, the lamp should be properly focused in the reflector. The filament can be located at the proper height to place it in the focus line if the dimensions of headlight are stated.


1º TROLLEY
TWO WAY SWITCH
16 C P RAILWAY LAMPS.
HEADLIGHT 32 C.P. LAMP
HEADLIGHT 32 C.P. LAMP
GROUND
CAR WIRING DIAGRAM SHOWING MULTIPLE SERIES CONNECTIONS OF 32 C P HEADLIGHTS AND STANDARD 16 C P RAILWAY LAMPS.

CONNECTION FOR HEADLIGHT LAMP.

A plan adopted by several companies with excellent results is to make the socket in the headlight adjustable, both vertically and laterally. By the movement of a pair of thumb-screws, this enables the motorman to focus the lamp positively and accurately.

These headlight lamps have been in use on a number of street railways for the past two or three years, during which time they have given thoroughly satisfactory service. They are regarded with much favor by all roads that have tried them, as they are inexpensive and simple in their application and operation.

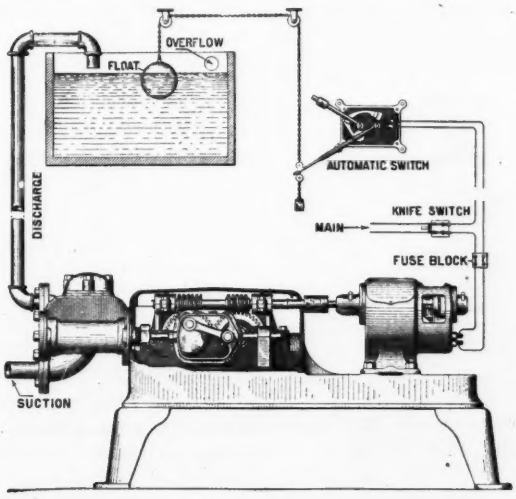
SPIRAL FILAMENT LAMP, WITH PARABOLIC REFLECTOR.

A New Automatic Electric Pump.

The accompanying engraving illustrates a new electric pump manufactured by the Automatic Electric Company, 170 Broadway, New York, designed after many years' experience by the builders with this class of machinery. It embodies all necessary features to make it a perfected electric pump. The water cylinders are of the standard double-acting duplex type used in pumping machinery for many years; the pistons have flexible packing which may be cheaply and quickly renewed when necessary. The mechanism for driving the pistons, and for transmitting the power of the motor to the pump, are combined and enclosed in a case containing oil enough to run a year without refilling. By this means ample, positive and permanent lubrication of all working parts is automatically secured. The motor, as may be seen, is connected directly to the pump, without the inter-

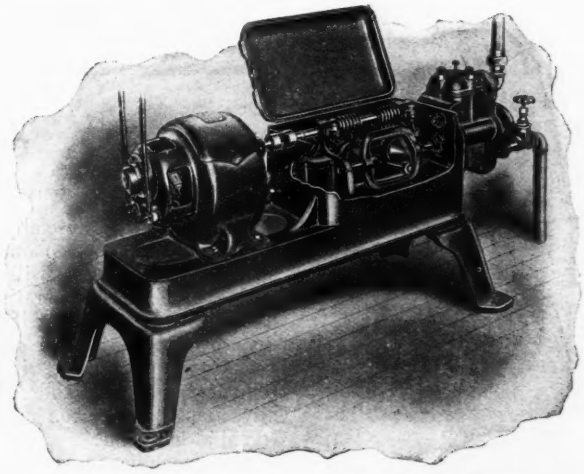
vention of belts, spur-gearing, or other noisy and troublesome devices.

As illustrated very clearly, the power of the motor is transmitted through a



AUTOMATIC ELECTRIC PUMP—DIAGRAM OF CONNECTION.

shaft and double worms to double worm-gears, and from cranks upon one of these gears to the yoke-pieces which are connected to the piston rods. This makes an absolutely noiseless mechanism, and the double worms and gears eliminate all end thrusts. In fact, the mechanism is such that it dispenses with any necessity for attention or mechanical skill, which especially suits it for domestic service. These worms reduce the high speed of



AUTOMATIC ELECTRIC PUMP—READY FOR SERVICE.

the motor to a moderate speed for the pump, thus ensuring a smooth, noiseless pumping action.

The motor is connected to the pump by means of a universal compensating clutch, securing flexibility to the motor and worm shafts, and avoiding friction loss.

A very important feature in the installation of these pumps is the electric switch placed at the tank for starting and stopping the pump automatically. Thus the tank is always kept full without requiring the service of an attendant. Of course this is only necessary where automatic operation is required, as the pumps are especially advantageous for any class of pumping, whether or not automatically controlled.

Every pump comprises a bed-plate, with the pump, motor and mechanism properly assembled and bolted thereon, ready for starting, and is mounted upon four legs ready to be set in place where desired without any foundation or preliminary work or expense. For this reason the pump, as shipped, can be located, connected up and started as soon as received without any delay, labor or expense other than that required for the requisite wiring and piping.

Some New Electric Specialties.

In Fig. 1 is shown a view of a new boring machine which is being used with general satisfaction by a large number of electricians. This boring machine has ball-bearings and universal bit-holders, and is built so as to telescope to four and one-half feet, and to extend to twelve feet. The telescoping parts are made of bicycle tubing, nickel-plated and polished, and the set-screw action is positive and permanent. The machine is essentially an overhead portable boring machine, with an extension adapted to rest on the floor and an adjustable column provided at the top with a bearing for the rotating shank of the bit. An endless sprocket chain passes over a sprocket-wheel, directly secured to the shank of the bit and a revolving sprocket idler at the lower end of the column. This transmits the motion to the body, and the operator has full control of the column in all positions as it stands alongside of him on the floor.

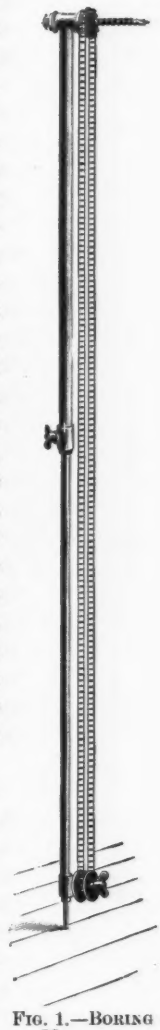


FIG. 1.—BORING MACHINE.

Fig. 2 shows a self-tying knob, for which some important features of value are claimed. These self-tying knobs are made of porcelain, and the hook on the bottom of the knob is so adjusted that it serves the purpose of a tie wire and facilitates the work of putting up electric light wires. These porcelain knobs conform fully to the rules of the National Board of Fire Underwriters, and have

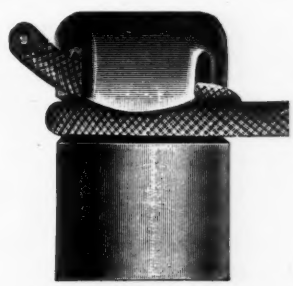


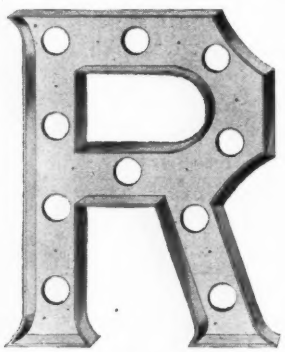
FIG. 2.—SELF-TYING KNOB.

received the commendation of architects wherever they have been in use.

These specialties are manufactured by the Henderson Electric Company, 1334 Montana street, Chicago, Ill.

Electric Signs.

The accompanying illustration shows the type of new electric sign which is being manufactured by the Pacific Electric Company, La Crosse, Wis. This is designated as the Pacific reflector letter, and the characteristic feature of these letters is that they are made from what is known as the Pacific protective reflector, having reflector sides. The lamps are set in a form of trough, which causes them to apparently stand out in letters of intense illumination, instead of wasting the light on the street. These signs can be read at nearly right angles, so that the full value of the letter is appreciated, no matter where the spectator may be standing. The boards of these signs are made from dry, thoroughly seasoned lumber, and are put together with tongue and groove and water-proof glue. Each sign receives two coats of priming before the finishing coat. The backgrounds are smalt finished, and the



ELECTRIC SIGN LETTER.

porcelain receptacles are fitted with copper shells. All connecting wires are soldered to the receptacle screws, and the back of each receptacle is then covered with a composition of asphaltum, making them moisture-proof.

The Gilmore Socket Case.

TO THE EDITOR OF THE ELECTRICAL REVIEW:

We call your particular attention to a notice in your paper under date of March 14, "Legal Note, Gilmore Socket Case." This is a misstatement, for the General Electric Company has not won the suit which was brought against Henry A. Truit, trading under the name of the Imperial Electric Company. A temporary injunction was granted, but the suit will not be decided for some time to come. We therefore request that you make correction of your statement.

GILMORE ELECTRIC COMPANY.
WILLIAM GILMORE.

A Calculating Automatic Time-Stamp for Telephone Switchboards.

In a number of exchanges there has been created a demand for an accurate automatic time-recording and calculating machine, in connection with the

TIMOMETER MODEL NO. 1, WITHOUT DIAL.

operation of telephone toll lines. A new invention to serve this purpose, called the timometer, has been placed on the market by the Automatic Time Stamp Company, 160 Congress street, Boston, Mass. This company has been the originator of many forms of automatic time stamps and calculating devices, and especially of the automatic time-printing machines of the kind in which a miniature time dial and hands are printed on the recording tape or blanket. The timometer is the invention of Mr. John C. Wilson, of Boston, Mass., and is an adaptation of the automatic time-stamp to print the exact hour, minute, quarter-minute or second, A. M. or P. M., and the date when a toll line conversation begins and when it ends,

TIMOMETER MODEL NO. 2, WITH DIAL.

and to calculate and print the elapsed or intervening time to a quarter of a minute, or to the exact second, as required.

This apparatus is made in three forms, shown as model No. 1, model No. 2 and model No. 3. These are shown in the accompanying illustrations. Models No. 1 and No. 2 may be fitted with either wheel or type dating devices, while No. 3 is restricted to the use of the latter.

In model No. 1 the time is not visible, while models No. 2 and 3 are provided with visible clock dials and with hands which move in unison with the time-printing hands, these machines thus serving as both timepieces and stamps. Model No. 2, although generally similar to model No. 1, is larger and has its visible clock face placed perpendicularly in front, while model No. 3 is rectangular in shape and has a visible clock dial in horizontal position on top.

Models No. 1 and No. 2 print upon the bottom of the toll ticket, and are operated by a blow, while No. 3 prints upon the top of the toll ticket, and is operated noiselessly by a press lever which moves the ribbon forward automatically at each operation. Either model may be used also as an automatic time-stamp for time-stamping letters, telegrams, orders, etc.

TIMOMETER MODEL NO. 3.

Model No. 3 is especially adapted to be fitted into the telephone switchboard shelf so that its base will be on a level with the shelf, the operating lever being underneath the same, or it may be placed upon a pedestal or other suitable support. In this model, the ink-ribbon is twenty-four feet in length and feeds automatically, and a new ribbon may be easily inserted at any time.

The machines are all strongly made and well finished. The clocks are good timekeepers, and are enclosed in dust-proof cases, especially model No. 3, and are not interfered with by the operation of printing. Models No. 1 and No. 2 do not print seconds, but are arranged to print the actual time and the elapsed time to a quarter of a minute, or upon a toll-line slip or ticket.

Model No. 3 may be arranged to print a time record similar to that of models No. 1 and No. 2, or to print the actual time and the elapsed or intervening time to the exact second.

Conduit Fasteners.

The Hart & Hegeman Manufacturing Company, Hartford, Ct., is placing on the market a new style of conduit fastener, which is claimed to be a great time-saver and affording facilities for convenience in operation for contractors and wiremen. These fasteners provide a quick, cheap reliable method of securing flexible

CONDUIT FASTENER.

conduit in boxes or wall cases. They are made for three-eighths or one-quarter-inch conduit.

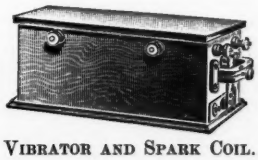
The accompanying illustrations show the fasteners both before and after application

CONDUIT FASTENER, APPLIED TO FLEXIBLE CONDUIT.

to the conduit. In manipulating these fasteners, the conduit is pulled through the outlet and the little brass collar is forced over the end. The sharp teeth readily engage the fabric and hold the conduit firmly in its place.

Spark Coils.

The Electric Contract Company has become general agent for E. Q. Williams, of Syracuse, N. Y. This firm is the manufacturer of Williams's improved sparkers for gas and gasoline engine ignition. The accompanying illustration



VIBRATOR AND SPARK COIL.

shows the style "A" vibrator manufactured by this company. This apparatus is claimed by the manufacturer to be very positive in use, giving a good, strong spark at all times, and being very quick in action. The apparatus is put up in polished oak boxes, with either flexible leads or binding-posts. The size is four inches by eight and one-half inches by three and five-eighths inches, and the weight is five and one-quarter pounds.

The Electric Contract Company will remove, on April 15, to new quarters at 202-204 Center street, New York city, where it will make use of a very much enlarged plant. This company is about to place on the market a large cell for automobile and station use.

A New Plant for the Manufacture of Electrical Apparatus.

The Western Electric Company, Chicago, Ill., has bought a plot of land comprising an area of about 109 acres. This land lies just east of Hawthorne. On this tract the Western Electric Company will build structures costing $1,200,000, to be used for the manufacture of its products. The location is very good for this purpose, as it is on two railroads —the Chicago, Burlington & Quincy and the Chicago & Western Indiana Belt Line, besides being one of the principal diagonal thoroughfares of the city. Plans have already been made for the cable factory, comprising a group of one-story buildings with an aggregate floor area of about 150,000 square feet. Plans have also been made for a large machine shop and iron foundry. The present capacity of the power plant will be 4,000 horse-power, and the works will employ about 1,200 hands.

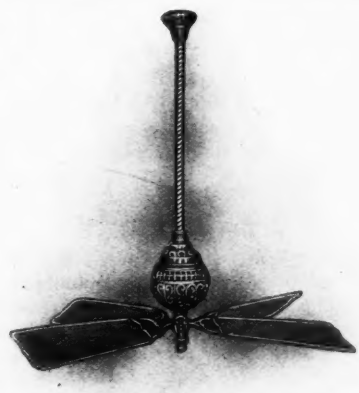
Steam Turbines.

A recent authority has computed the total aggregate power of steam turbines in use or under construction or ordered in different parts of the world for the present time at about 500,000 horse-power. Of this total the greater portion is used or is intended for the driving of dynamos, alternators or other electrical machinery, while the next in point of numbers or power consumption is for marine service.

In reference to this, the contract recently given to the British Westinghouse Electric and Manufacturing Company, Limited, by the Metropolitan District Railway Company, of London, England, for four turbo-alternators, is noteworthy. Each of these machines is designed for a normal capacity of 5,500 kilowatts, but will be capable of carrying an overload of fifty per cent, giving for each unit a maximum of 8,250 kilowatts, or about 11,000 electrical horse-power. Notwithstanding the great power that they will develop, the dimensions of these engines are only twenty-nine feet in length by fourteen feet wide, and twelve feet high, the over-all length of turbine and alternator being fifty-one feet nine inches. The steam pressure will be 165 pounds per square inch, and the speed 1,000 revolutions per minute. It is stated that these turbines are the largest which have ever been built up to the present time.

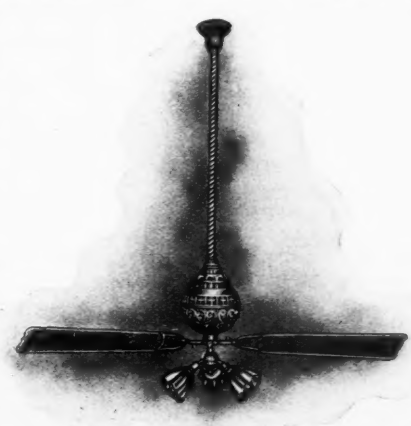
Four-Bladed Ceiling Fans.

Two notable improvements have been made in the design of the well-known Tuerk alternating-current ceiling fans for the season of 1903. While the two-



FOUR-BLADE CEILING FAN.

blade model is increasing in popularity in every way favorable to the company, the great demand for a four-blade fan has induced the manufacturers to place upon the market the model shown in the accompanying illustrations. In addition to making a model with four blades, the electrolier fan is now so constructed



TWO-BLADE ELECTROLIER FAN.

that the electric lights are below the fan, which is generally conceded to be a step considerably in advance in this line of construction.

E. B. Latham & Company, 39 Vesey street, New York city, are the general agents for the Tuerk fans, which are manufactured by the Hunter Fan and Motor Company, Fulton, N. Y.

CURRENT ELECTRICAL NEWS

DOMESTIC AND EXPORT.

MONTREAL LIGHTING PROJECT—A deal has been completed in Montreal, Canada, by which the Montreal Light, Heat and Power Company secures control of the Lachine Hydraulic and Land Company. The price is said to be about $3,781,000. This gives the Montreal company control of all the electric power in Montreal, as well as the gas service.

NEW CALIFORNIA POWER PROJECT—Articles of incorporation for the California Power and Development Company have been filed, the capital stock being stated at $5,000,000. The purpose of the company is said to be the securing, development and utilizing of all forms of modern power, with the acquiring of land and water rights in connection therewith, and the carrying on of other phases of business of a kindred character. The directors, as announced, are: S. H. Plate, San Jose; I. Meyer, Lincoln, Cal.; Donald H. Fay, J. I. Honn and J. J. McIntyre, of San Francisco.

OHIO ROAD INCREASES ITS CAPITAL STOCK—The Dayton, Springfield & Urbana Electric Railway Company has increased its capital stock from $500,000 to $1,500,000, in agreement with the action taken by the stockholders last October. The purpose of the increase is chiefly to create a through double-track line. The road is one of the Appleyard Company's properties, and operates twelve miles of track in Springfield, two and one-half miles in Dayton, and two and one-half miles in Urbana, with forty miles of interurban lines between these cities. Mr. John S. Harshman is president of the company. This road has leased the Urbana, Bellefontaine & Northern, a road now in course of construction, and has guaranteed its bonds, principal and interest, for thirty years.

THE COST OF ELECTRIC LIGHTS AT ST. JOSEPH, MICH.—Mr. W. Worth Bean, president of the Benton Harbor & St. Joseph Electric Railway and Light Company, has compiled an elaborate report showing the true cost of electric lights for the city of St. Joseph, Mich. The board of public works of St. Joseph, Mich., submitted January 24, 1903, a report showing the condition of the plant and the cost of operating and maintaining the system. Without commenting on the elements of the controversy, the figures which Mr. Bean has prepared from the city records make interesting reading, as showing the operation of a municipal plant for a city of this size. The total expenses for the year were $958.22. The total plant cost was $18,997.73, making a total cost of $19,955.95. Credit by premium on the bonds amounted to $440, making the interest-bearing debt $19,515.95. The plant started with 121 arc lights, and during the year three extra lamps were added. The plant is operated by a 100-horse-power gasoline engine, driving a seventy-five-kilowatt Westinghouse alternator. The operating account is stated to be as follows: For gasoline, $3,728.93; for telephones, telegrams, freight and drayage, $28.68; for labor, $895; for carbons, $184.92; oil and waste, $114.34; globes, $175.31; miscellaneous, $213.50; dynamo and engine repairs, arc lamp repairs, $109.92, making a total of $5,618.43. Including cost of operation, interest and depreciation at seven per cent, the price of the lights for the year 1902 was $57.96 per lamp.

TELEPHONE AND TELEGRAPH.

BOULDER, COL.—Work on the new telephone building for the Colorado Telephone Company in this city will be begun at an early date.

PEKIN, ILL.—The Urbana city council has passed an ordinance extending the franchise of the Home Telephone Company to thirty years.

NORTH ADAMS, MICH.—A cooperative telephone company has been organized at Camden, the system to cover the entire township. It is capitalized at $10,000.

CLIMAX, IOWA—A new mutual telephone company has been organized in this locality, with R. N. Withrow as president; O. E. Davis, secretary, and E. A. Goss, treasurer.

GAYVILLE, S. D.—The West Side Telephone Company has been organized, to erect and operate a line in this town and vicinity. The president is George McCone, and J. O. Aaseth is secretary.

BIRMINGHAM, ALA.—The Postal Telegraph and Cable Company has started work on building an entirely new line between Birmingham and Memphis, the route to be along the 'Frisco system right of way.

WATTERSTOWN, WIS.—A new telephone company has been organized in this town, known as the Oak Ridge Telephone Company. The officers are: Frank Pospipal, president; W. H. Lee, secretary, and James Reid, general manager.

SIGOURNEY, IOWA—At the recent annual meeting of the Harper Mutual Telephone Company, No. 3, the following officers were elected: President, William Snakenburg; vice-president, A. Dubois; secretary, Ed. Lures; treasurer, A. Hoffman.

STATESVILLE, N. C.—A new telephone company, to be known as the Rocky Creek Telephone Company, has been organized in Olin by the following: L. C. Meyers, J. R. Hule, N. T. Summers, T. L. Jennings, W. L. Hollard, C. A. Tomlin, N. D. Tomlin, R. B. Reid.

DRYDEN, N. Y.—At a recent meeting of the stockholders of the Dryden-Harford Telephone Company, it was announced that sufficient money had been subscribed to ensure the building of the line. The following officers were elected: President, J. J. Tripp; secretary, Z. B. Lormor; treasurer, C. F. Cole.

SARATOGA, N. Y.—As soon as the weather will permit, the Western Union Telegraph Company and the Great Northwestern Telegraph Company will again take up the work of joining New York to Montreal with heavy wires, to meet the pressing demands of increasing business between the two points.

DES MOINES, IOWA—The Iowa Telephone Company has elected the following officers: President, C. E. Yost, of Omaha; vice-president, F. H. Griggs; secretary and treasurer, J. B. Mason; general manager, E. B. Smith. The stockholders sanctioned the expenditure of over $700,000 for improvements and extensions to the company's lines.

TRENTON, N. J.—The Hopewell Telephone and Construction Company has elected the following officers: President, John N. Race; vice-president, Dr. T. A. Pierson; secretary and treasurer, Theodore M. Hall; manager, J. M. Ege. The directors of the company are: J. N. Race, T. M. Hall, F. F. Holcome, T. A. Pierson, J. M. Ege, George Snowden and George E. Pierson.

CLEVELAND, OHIO—The American De Forest Wireless Telegraph Company, through its counsel, Mr. Francis Butler, of New York city, has closed negotiations for an operating site in this city. The company has obtained a long-time lease on a plot of ground along the lake front east of the city limits. Preparations will be started at once for the erection of the apparatus, and the officers expect the station to be in working order by the first of June. There are stations already built in Detroit and Hamilton, Ontario.

LITTLE VALLEY, N. Y.—A certificate of incorporation has been filed in the county clerk's office for the Gowanda Telephone Company, with a capital of $25,000. The line will operate in Gowanda and from there to the adjacent villages of Perrysburg, Nashville, West Perrysburg, Silver Creek, Iroquois, Lawton, Collins, Collins Center, North Collins, Hamburg and Little Valley. The names of the directors selected for the first year are: E. C. Fisher, J. N. Congdon, William H. Britton, Jr., William A. Dietrich and William R. Smallwood.

ELECTRICAL SECURITIES.

Since the first month of 1902, the level of prices has not been so low as that which was reached during the past week. While this condition would seem to point to a decidedly retrograde movement, it is confidently assumed in many quarters that it is but a temporary lagging prior to a decided boom in speculative operations. The commission firms have been seriously imposed upon by the great lack of interest taken in speculation by the buying public, and have suffered greatly in this direction. It is expected that the speculative sentiment will be very much improved by a continued easy market for money, and that the excellent weather conditions prevailing will do much to strengthen the tone of the market in general. By the middle of the month a very much improved condition of affairs is confidently looked for.

ELECTRICAL SECURITIES FOR THE WEEK ENDING MARCH 28.

New York:	*Closing.*
Brooklyn Rapid Transit	65¼
Consolidated Gas	204¼
General Electric	190¼
Kings County Electric	225
Manhattan Elevated	138
Metropolitan Street Railway	134¾
New York & New Jersey Telephone	165
Westinghouse Manufacturing Company	211

It is stated that the directors of the Kings County Electric Light and Power Company have decided to issue about May 7 $1,250,000 of new stock, at par, under the recent authorization to double the company's capital stock.

Boston:	*Closing.*
American Telephone and Telegraph	161½
Edison Electric Illuminating	280
Massachusetts Electric	91
New England Telephone	138
Western Telephone & Telegraph preferred	98

The New England Telephone and Telegraph Company has declared a regular quarterly dividend of 1½ per cent, payable May 15. Transfer books close April 23 and reopen May 11.

Philadelphia:	*Closing.*
Electric Company of America	9
Electric Storage Battery common	79
Electric Storage Battery preferred	79
Philadelphia Electric	6⅞
Union Traction	46¾
United Gas Improvement	167⅜

Chicago:	*Closing.*
Chicago Telephone	150
Chicago Edison Light	155
Metropolitan Elevated preferred	80
National Carbon common	24½
National Carbon preferred	98
Union Traction common	9¼
Union Traction preferred	40

The general balance sheet of the Chicago Telephone Company as of December 31, 1902, is as follows: Assets—Plant, $11,207,213; real estate and buildings, $1,111,645; material, $366,460; bonds (sundry), $14,500; bills and accounts receivable (net), $68,435; cash, $134,706. Liabilities—Capital stock, $11,993,400; reserve for taxes, $94,623; reserve for renewals, $346,531; reserve for unearned rentals, $36,593; reserve for outstanding tickets, $4,411; surplus, $427,383.

AUTOMOBILE NOTES.

AN AUTOMOBILE COMBINE—A formal announcement has been made of the organization of the Association of Licensed Automobile Manufacturers. The association, according to a statement made by Mr. Henry D. MacDona, the counsel for the new concern, secures to its members the use of the Selden patent, a suit over which has just been at issue, and was decided recently in favor of the Electric Vehicle Company, against two other well-known automobile manufacturers. Four hundred other patents are secured by the association, and one of the chief objects of the organization is to save the immense amount of money which is spent in litigation between the different manufacturers.

AUTOMOBILE EXPOSITION AT BRUSSELS—Consul G. W. Roosevelt reports from Brussels, Belgium, February 17, 1903, that an international exposition of automobiles, cycles and motor cycles was held February 7 to 16 in the Cinquantenaire Park, Brussels. There were 150 exhibits, ranging from a powerful truck of twenty or forty horse-power, to a voiturette of six or eight horse-power. One solidly constructed truck had a carrying capacity of six tons and a hauling capacity of six additional tons, with an average speed of seven and three-quarter miles per hour. The consumption, either of alcohol or petroleum, was a little over one quart for two miles, and its capacity permitted a run of over ninety miles without refilling. The report states that the only really new device transformed the front or gear wheels into motor wheels. A concealed adjustment operated the motor. The steering gear could be adjusted to any desired height, and the mechanism operating the forward motor could be attached to any carriage.

COMMERCIAL VEHICLE CONTEST—The Automobile Club of America will hold a commercial vehicle contest on May 20 and 21. This contest will be open to all types of self-propelled vehicles used for commercial purposes, made in the United States or abroad. An observer will be placed on every vehicle, and on the first day vehicles in all classes shall cover the route without stops, except those which are involuntary. On the second day the vehicles shall cover the route, making various specified stops, according to the class in which the vehicle stands. The route is about twenty miles long, consisting of a run from the clubhouse, at Fifth avenue and Fifty-eighth street, to the Battery, at the foot of Broadway, New York city; from the Battery uptown and through the northern part of the city, and back to the clubhouse. Vehicles in each class are to go twice over this route (forty miles) on each day of the contest. Each contestant is to furnish his own dead load, consisting of whatever material he may see fit to carry. This will be weighed and checked by the contest committee. The committee will provide at the starting point a certain amount of ballast in convenient form to be available to supply any deficiencies in contestants' loads. The contestants will be required to report to the committee's representatives at the weighing station on the day before the contest with their vehicles empty, so that they may be weighed in that condition, and again (with their dead load on board) on the morning of each day of the contest, to be weighed and checked by the committee. The amount of gasoline, electricity, coal, etc., consumed (which shall be furnished by contestants), will be measured, and the cost of operation per ton-mile ascertained. There is to be a class for electric vehicles. The electric vehicles will be required to go twice over the twenty-mile route each day. Each electric vehicle shall be allowed one stop, not exceeding three hours, for recharging batteries, the time of such stop and the amount of current taken to be recorded against the vehicle. Ampere-meter and voltmeter readings will be taken each day, before and after the run, and before and after all intermediate rechargings. Electric vehicles will be subdivided into four classes, as follows: (1) To carry a dead load of 750 pounds and to make 100 specified stops on the second day's run; (2) to carry a dead load of 2,000 pounds and to make 100 specified stops on the second day's run; (3) to carry a dead load of 3,500 pounds and to make twenty specified stops on the second day's run; (4) to carry a dead load of 10,000 pounds and to make ten specified stops on the second day's run. Each vehicle must carry a dead load of at least seventy-five per cent of its own weight, in addition to the driver and observer. The regulations for steam and gasoline vehicles, with the exception of the conditions laid down for charging, are similar to those for electric vehicles. In each of the four classes for electric, steam and gasoline vehicles, medals will be awarded, based on economy in cost of operation and time consumed in covering the course within the legal limit of eight miles per hour. In each of the classes a gold medal will be awarded to the vehicle making the best performance; a silver medal to the vehicle making the second best performance, and a bronze medal to the vehicle making the third best performance. Messrs. John A. Hill, Emerson Brooks and Roland R. Conklin compose the contest committee.

ELECTRIC RAILWAYS.

HUNTINGTON, W. VA.—It is stated that capitalists of this place will build an electric line from Washington, D. C., to the falls of the Potomac, a distance of twenty miles.

DUBLIN, TEX.—A company of capitalists, including J. W. Riggins, of Waco, is contemplating the building of an electric line from Hamilton to connect with the Texas Central, and probably go on to Glen Rose and Cleburne.

DEPERE, WIS.—Depere has granted a franchise to the Knox Construction Company to operate an interurban road through the city, and also to the Fox River Electric Company to run a line on the principal street of the east side.

PHILADELPHIA, PA.—Many miles of new track, mostly covering new territory, will be laid by the Philadelphia Rapid Transit Company during the summer and fall of this year. Different sections of the city, now inaccessible, will be connected by the laying of new lines and the extension of the system.

ALBANY, N. Y.—Articles of incorporation have been filed by the South Shore Traction Company, which is capitalized at $2,000,000, to build and operate an electric railway sixty miles long in Suffolk and Nassau counties, from Jamaica, Long Island, to Patchogue and Brookhaven. The company has already applied for a franchise in Patchogue.

PITTSBURG, PA.—The Du Bois Electric and Traction Company, of Du Bois, has taken out a charter under the laws of New Jersey, and has placed $300,000 in bonds. It is the intention of the corporation to entirely rebuild the Du Bois system and expend over $200,000 the coming summer in extending the road to Falls Creek and other near-by places. It also proposes to extend the electric light system.

NORWICH, CT.—It is rumored that the Worcester & Eastern Connecticut Railway Company, which already has in operation a line connecting Worcester, Mass., and Central Village, Ct., will this summer begin the construction of a trolley line from Norwich to Jewett City. The line will subsequently be extended from Jewett City to Central Village, thus forming a continuous trolley between Norwich and Worcester.

MARION, IND.—A charter has been asked by the Northern Indiana Traction Company, composed of Marion and eastern capitalists, organized for the purpose of building a road from this city to Wabash, and thence to Warsaw. Articles of incorporation will be filed in the near future and the company will elect officers and directors. The company desires a private right of way, and if this can be secured, work will begin in the spring.

ROCKVILLE, IND.—Articles of incorporation of the Indianapolis, Dansville & Rockville Traction Company have been filed in Indianapolis. The incorporators are: W. F. Churchman, Everett Wagoner, W. B. Blair, Cyrus Osborn, A. L. Symons, W. B. Brickett, H. H. Underwood, John W. Trotter, George T. Pattison, William C. Osborn, Charles P. Hornaday, John Ader and Ausburn Rudd. The proposed route will be inspected at once. The line will be built to Rockville, and the power-house will be located at Dansville.

BALTIMORE, MD.—The deal for the sale of the Annapolis, Washington & Baltimore Railroad to the syndicate engaged in building the trolley line between Baltimore, Annapolis and Washington has been closed and the final payment for the property has been made. This deal is the sale of $358,000 of the capital stock of the company. A new board of directors was elected, as follows: William H. Lamprecht, Cleveland, Ohio; Alfred R. Horr, Cleveland; Harry A. Garfield, Cleveland; Calvary Morris, Cleveland, and Frank Gosnell, Baltimore.

BUFFALO, N. Y.—James W. Holcomb, who represents a syndicate which intends to build an electric line to connect Buffalo and Cleveland, says that the work of building the road will be begun within thirty days. The syndicate now controls two lines—the Buffalo, Dunkirk & Western, and the Cleveland, Painesville & Ashtabula. These are about sixty miles long. It is stated that the plan is to connect the Cleveland, Painesville & Ashtabula line with other lines that have been built in cities along the route, and to make a through line from Buffalo along the lake shore to Cleveland.

ELECTRIC LIGHTING.

SHEBOYGAN, WIS.—This city has decided to build an electric lighting plant, to cost $275,000.

JOHNSON CITY, TENN.—It is stated that the city contemplates installing an electric light plant at an early date.

BARNESVILLE, MINN.—It is stated that the city officers of Pelican Rapids are considering the installation of an electric light plant.

HARTFORD CITY, IND.—At a special meeting of the city council a twenty-year franchise was granted to the Hartford City Electric Company.

MINNEAPOLIS, MINN.—The stockholders of the Minneapolis General Electric Company have voted to increase the capital from $750,000 to $1,000,000.

MOUNT PLEASANT, UTAH—Spring City is arranging for an electric lighting plant to be used for street and residence lighting. It will be installed immediately.

WHATCOM, WASH.—The Frizell Electrical Company has been transferred to H. L. Lively, Herman Rowe and J. R. Francis, and its name changed to Whatcom Electric Company.

MEDINA, OHIO—The Medina Electric Light and Power Company has sold out to a Cleveland company which has already taken possession. The new company will continue the contract with the town.

NASHVILLE, TENN.—The receivers of the Nashville Railway have been authorized to borrow $150,000 additional on receivers' certificates to complete the work on the plant of the Cumberland Electric Light and Power Company.

DES MOINES, IOWA—The Cedar Falls & Janesville Power Company has asked the city council for a franchise to furnish the city and citizens electric lights, and the question will be voted upon at the regular election in the spring.

KENDALLVILLE, IND.—It is stated that Hugh M. Boozer, of Waterloo, and a number of Syracuse business men, have organized a $60,000 company to utilize the water power of the Elkhart River. They will build an electric lighting and power station.

TRENTON, N. J.—A merger of the Hopewell and Princeton electric lighting industries has been effected. The president is C. P. Fitch, of Princeton, and the vice-president, Orrell A. Parke, of New York. A large lighting plant will be situated in Rocky Hill.

PHILADELPHIA, PA.—Cramp, Mitchell & Serrill, the Philadelphia bankers, who have completed the purchase of the gas and electric light plants at Easton, Pa., and Phillipsburg, N. J., will shortly organize a company consolidating the plants. The new company will make many improvements.

MUSKOGEE, I. TER.—The city council of Tahlequah has granted a twenty-five-year electric lighting franchise to C. W. Turner, of this city. The light plant for Tahlequah will be taken from this city to that place, and a new one with four times the capacity of the present one will be installed in its place.

OCEAN SPRINGS, LA.—The stockholders of the Ocean Springs Electric Light and Ice Company, recently incorporated, have organized and elected the following officers: President, Sidney J. Anderson; vice-president and treasurer, H. F. Russell; secretary, L. A. Lundy. The machinery for the plant has already been purchased, and the contract let for the building. It is expected that the plant will be in operation in about six weeks.

CHARLESTON, W. VA.—Preliminary steps for the organization of the Charleston Light and Power Company have been taken. The company will be composed of Senator Stephen B. Elkins, David Elkins, State Senator Charles W. Swisher, of Fairmount, W. Va., and a number of other West Virginia capitalists. The company recently purchased the street railway, waterworks and electric light companies of Charleston, and a company embracing the three plants will be organized at once. For a time the offices of the company will be located in Washington, after which they will be removed to Charleston.

PERSONAL MENTION.

MR. H. D. ADAMS, JR., has opened a new salesroom for the Clifton Manufacturing Company at 308 West street, New York city. The Clifton Manufacturing Company is a Boston institution.

MR. E. H. KEATING, general manager of the Toronto Street Railway Company, has been appointed by the government as one of the commissioners to report on the most suitable site for a dry dock in Montreal.

MR. F. B. T. LEE, vice-president and general manager, John Martin & Company, San Francisco, is now in the East, visiting the home offices of the various large manufacturing companies which that firm represents on the Pacific coast.

MR. SAMUEL HARRIS, general manager of the Lehigh Valley Traction Company's system, with headquarters at Allentown, Pa., has resigned. It is said that Mr. A. H. Hayward, formerly superintendent of the Allentown & Bethlehem Rapid Transit Company, will succeed Mr. Harris.

MR. SHELDON J. GLASS, secretary and treasurer of the Milwaukee Gas Light Company, has accepted the appointment as secretary and treasurer of the American Light and Traction Company, Milwaukee, Wis. The office of this company is at 40 Wall street, New York city, and it is expected that Mr. Glass will take up his active duties in this city about May 1.

DR. MARTIN CROOK, brother of Mr. J. F. Crook, of the Automatic Electric Company, of Chicago, Ill., has been selected as medical officer to the corps of telegraph operators and assistants who are to have charge of the station on Midway Island, in the Pacific Ocean, established by the Pacific Commercial Cable Company in connection with its transpacific cable.

MR. HENRY L. DOHERTY, chairman of the committee on the analysis of flue gases of the National Electric Light Association, will make a complete report on this subject at the twenty-sixth convention, which will be held in Chicago, May 26, 27 and 28. A practical demonstration will be given of a simple method of detecting and preventing the loss of a great deal of power that is often allowed to go to waste. This report will undoubtedly be of great interest to central station managers who are not satisfied with the results they are obtaining from the fuel consumed.

OBITUARY NOTICE.

MR. JOSEPH KAVANAGH, New York city and Long Branch, N. J., died on Wednesday, March 25, after an illness of seven months. Mr. Kavanagh has been a prominent factor in the development of the telephone business. He was assistant treasurer of the New York Telephone Company, and of its predecessor, the Metropolitan Telephone and Telegraph Company, from the date of their organization, and was treasurer of the East Jersey Telephone and Telegraph Company and the North Jersey Telephone and Telegraph Company. Mr. Kavanagh is survived by a wife and four children. Mrs. Kavanagh is a daughter of the late Amzi Dodd, the founder of Dodd's Express.

INDUSTRIAL ITEMS.

THE BALL-WOOD COMPANY, manufacturer of automatic cut-off engines, will remove on May 1 from 120 Liberty street to the Whitehall Building, No. 6 Battery Place, New York city.

THE MANUFACTURERS' AGENTS ASSOCIATION, Los Angeles, Cal., has moved into new office and storeroom quarters at 308 South Los Angeles street. The company is now in better shape than ever before to represent manufacturers' interests in California and Arizona.

THE VARLEY DUPLEX MAGNET COMPANY, Phillipsdale, R. I., has recently issued a new edition of its catalogue of electromagnets for continuous and alternating currents. The Varley company manufactures electromagnets and all kinds of coil windings of insulated and bare wire.

THE F. BISSELL COMPANY, 228 Huron street, Toledo, Ohio, is distributing a series of catalogues descriptive of its specialties for telephone construction, switchboard apparatus, and devices for electric lighting, power and railway construction. These catalogues are very complete and give some valuable information for this class of apparatus.

THE ELECTRIC APPLIANCE COMPANY, Chicago, Ill., western agent for the Gutmann wattmeters and Adams-Bagnall arc lamps, states that its sales on lamps and meters for the past three months have surpassed that of any similar period in or out of season. Both of these factories have enlarged their facilities so that increased business is promptly taken care of.

THE BRODE ELECTRIC COMPANY, Inc., San Francisco, Cal., has moved into its headquarters at 306 South Los Angeles street. This departure is in order to accommodate an increasing stock of supplies. This company is desirous of securing catalogues from large manufacturers and jobbers who are interested in the development of their trade on the Pacific coast.

THE W. S. HILL ELECTRIC COMPANY, New Bedford, Mass., is continually adding to its perpetual catalogue, descriptive of knife switches, panel boards, cutouts, etc. The perpetual catalogue feature affords a comprehensive index at all times of the product which this company has on the market, and keeps the buyer accurately informed as to the development in this art.

THE NEW YORK CENTRAL & HUDSON RIVER RAILROAD COMPANY has introduced on its system one of the most complete electrical safety signaling systems which has yet been devised for railroad service. Mr. Charles Elley Hall, in a lengthy article in *Leslie's Weekly*, for March 5, describes this apparatus and tells of a number of tests which have been made of this system.

THE GRATON & KNIGHT MANUFACTURING COMPANY, oak leather belt maker, Worcester, Mass., is receiving a number of commendations on the wearing properties of its "Royal Worcester" belts. These belts are great power transmitters, and do not sag, slip or cause accident. The company is glad to quote prices, or will send a sample belt for free trial in any factory.

VALLEE BROTHERS ELECTRICAL COMPANY, 625 Arch street, Philadelphia, Pa., is distributing a list of special particulars in regard to direct-current desk and ceiling fans. These are the Crescent fans, twelve and sixteen-inch, three blades, 110 volts. The line also includes 220-volt desk fans and 220-volt ceiling fans, four wood blades, with sixty-inch sweep. The Vallee Brothers company has a large stock on hand of everything electrical.

T. H. BRADY, New Britain, Ct., one of the pioneers in the manufacture of electrical specialties for outside construction, has issued a new catalogue for 1903. This firm was established in 1879. The catalogue describes and illustrates mast arms, fuse and cutout boxes, knife switches, hanger boards, storm protectors, lamp holders, storm-proof pulleys, hoods, brackets, etc. The office is at 351 Main street, and the factory on Centre street, New Britain, Ct.

G. M. GEST, the conduit contractor, New York, N. Y., has been awarded a large contract for the underground conduit work in and around the L street central station of the Edison Electric Illuminating Company, of Boston, Mass. This construction will be heavy, having 186 ducts in one trench. This contractor has also been awarded additional contracts by the Brooklyn Heights Railroad Company, for underground conduit work along Flatbush avenue, Brooklyn.

THE OTIS ELEVATOR COMPANY, New York city, has been awarded a contract for eighteen electric elevators equipped with the push-button system of control. This is said to be the largest number of elevators of this type ever included in a single contract. These elevators are to be installed, one each, in a row of private residences now being constructed for F. Ambrose Clark, on Seventy-fourth street, between Central Park West and Columbus avenue, New York city.

CHARLES F. JOHNSON, 908 Ellicott square, Buffalo, has been unusually busy handling a large spring demand for general equipment supplies. Concerning "Johnson's Equipment Bulletin," which has recently been issued for March, the "Southern Lumbermen," of March 15, has this pleasant word to say: "'Johnson's Equipment Bulletin' is at hand . . . and is of special interest to parties who wish to buy or sell rails, motors, equipment, generators, engines, boilers and cars."

THE MICHIGAN CENTRAL, "Niagara Falls Route," has just published a new time card for all divisions. This is very carefully prepared and is easily understood. The Michigan Central is one

of the foremost railroads of the world, and makes every effort to secure perfect comfort in travel. Mr. O. W. Ruggles is the general passenger and ticket agent at Chicago, Ill., and Mr. William H. Underwood is the general eastern passenger agent, with offices at 229 Main street, Buffalo, N. Y.

THE MANHATTAN ELECTRICAL SUPPLY COMPANY, New York city, carries one of the largest stocks of electrical supplies in the country. The "Eureka" searchlight, which this company is finding very popular, is a simple, durable, convenient and safe electric light for the house, stable or store. This light is used without danger under any conditions. The case is made of metal, with leatherette cloth cover. The size, outside measurements, is one and one-half by nine inches.

R. G. DUN & COMPANY, New York, N. Y., has begun the publication of an international edition of *Dun's Review*, beginning with the issue of March, 1903. This international edition is in response to many requests, and in recognition of what the publishers believe is a well-defined need. The international edition will be a monthly and will not in any way cancel the scope or modify the plans of the weekly edition. The editorials and advertising are partly in English, Spanish and German.

THE LYON METALLIC MANUFACTURING COMPANY, 139 Fulton street, Chicago, Ill., manufacturer of every specialty in sheet metal, is receiving a number of orders for its well-known oily waste cans. These cans are made of galvanized iron, and stand on legs four inches from the floor. The cover is self-closing, and can not in any emergency be left open. The hinges are riveted on, and there is no solder used in the construction of this receptacle. These cans are made in any size desired.

THE STANDARD VITRIFIED CONDUIT COMPANY, 39 and 41 Cortlandt street, New York city, has issued a handsome souvenir, descriptive of its conduit and clay products, and gives a great deal of detailed information regarding the manufacturing of this material. Numerous half-tone illustrations show typical installations of conduit, and the book is valuable both from a picturesque and practical point of view. The book is very attractively bound, and is so arranged that it represents a section of vitrified conduit.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is making a specialty at the present time of the "Diamond special commutator compound." This compound is not a grease, but a combination of chemicals that acts as a lubricant, which stops sparking, puts a hard, glossy finish on the commutator, and prevents excessive wear of both commutator and brushes. It also increases the conductivity of brushes by removing dirt and keeping clean contacts. The Central Electric Company carries a large stock of this compound.

THE ELBLIGHT COMPANY OF AMERICA, New York city, has secured the contract to construct the large waving, flexible electric flag which will be used in the electrical decorations at the celebration of the opening of the Louisiana Purchase Exposition at St. Louis, on April 30. The only electrical display will be that completely outlining the mammoth Administration Building, this building being surmounted by the flag already mentioned. The Elblight system is adaptable for work of this nature, and the company is to be congratulated on securing so elaborate and important a contract.

THE CHICAGO FUSE WIRE AND MANUFACTURING COMPANY, 358 Dearborn street, Chicago, Ill., is making a specialty of fuse wire and strip for telephone fuses, instrument fuses, and, in fact, anything requiring a very low fusing point. These fine wires are made with the same degree of accuracy which has always been maintained for all of its product, and the wire has sufficient tensile strength to be handled without difficulty. The company is in a position to take care of orders, whether regular or special, in large or small amounts, and will make shipments promptly either from Chicago, New York or Buffalo.

THE LAWRENCE-HALL ELECTRIC COMPANY, Cincinnati, Ohio, has been organized with Mr. F. D. Lawrence—for over fifteen years with the Standard Electric Company—as president. Mr. Lawrence resigned from the Standard company a few weeks ago, and with Mr. W. A. Hall organized this new company and will actively enter the general electrical supply business. This company will act as agent for the Okonite Company, manufacturer of insulated wires and cables, of New York, and will in addition carry a large stock of modern electrical products. The territory tributary to this house is of much electrical importance, and the demand for electrical supplies in that section is constantly increasing.

THE DICKEY-SUTTON CARBON COMPANY has established a fine new plant at Lancaster, Ohio. The company has excellent railroad facilities, being located on the Hocking Valley Railroad, just on the outskirts of Lancaster. The factory has been equipped under the supervision of Mr. Edmund Dickey. The company makes use of natural gas to ensure uniform results in baking, and can guarantee a product of the highest quality. The factory is at present running with a full force of hands on electric light carbons and is about ready to fill any size of orders for enclosed arc carbons, dry and other battery carbons, carbon brushes, carbon specialties and electrolytic carbons. The Dickey-Sutton Carbon Company is incorporated under the laws of Ohio. The officers are as follows: H. M. Sutton, president and treasurer; Edmund Dickey, vice-president and general manager; U. S. Kolby, secretary; S. S. Wilson, assistant secretary; Robert R. Dickey, superintendent.

THE WESTERN ELECTRICAL SUPPLY COMPANY, St. Louis, Mo., has just issued and is mailing its general supply catalogue No. 50. The endeavor has been made in this catalogue to prepare one of the most complete and up-to-date expositions of general supplies, construction material, specialties, tools, etc., that has ever been listed. While not containing so many pages as the last catalogue issued by this company, the contents have been condensed, and it now lists at least twice the amount of material contained in the prior volume. No expense has been spared to secure a desirable result, and the company is to be congratulated upon the splendid appearance made by this catalogue, the mechanical preparation of which is all that could be desired. The contents embrace apparently everything that the electrician might require, and the great practical value of the volume is enhanced by a supplementary chapter of valuable information. This book may be had by those interested upon application to the company.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., manufacturer of the Chloride accumulator, has recently closed several large contracts for the installation of storage batteries in connection with street railway work on the Pacific coast. The Los Angeles Railway Company has contracted for three batteries, two consisting of 264 cells, having a capacity of 1,000 ampere-hours, and one of 264 cells, having a capacity of 2,000 ampere-hours. These batteries are to be operated in connection with differential boosters, for the purpose of regulation on the railroad load, and for reserve in any emergency which may arise, due to the temporary shutdown of machinery at the power-house. The Pacific Electric Railroad Company has also contracted for a battery of chloride accumulators consisting of 264 elements, of 1,000 ampere-hours capacity, to be operated in connection with a differential booster for regulation, peak work, and emergency use. Several batteries are also in process of installation for the following roads in this locality: The Oakland Transit Consolidated, the Los Angeles Pacific Railway, and the North Shore Railroad.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Rochester, N. Y., and Chicago, Ill., has secured a large contract for the central office equipment of the Home Telephone Company, Kansas City, Mo., and Kansas City, Kan. The contract comprises four exchanges as follows: The main exchange, having a capacity of 12,000 lines, will be equipped for the immediate operation of 4,500 lines with a capacity for 360 trunk lines, the present equipment being 120 lines. The east branch exchange will be an ultimate capacity of 7,200 lines and will be equipped for the immediate operation of 1,200 lines, 360 trunk lines ultimately, the present equipment being seventy-five lines. The south branch exchange will have a capacity for 7,200 lines and 360 trunk lines, the present equipment being 700 and seventy-five lines respectively. The Kansas City, Kan., exchange will have a capacity for 7,200 lines and 360 trunk lines, with a present equipment of 800 lines and eighty lines respectively. All of the above boards are to be of the bridged multiple-relay, lamp-signal, central-energy type. The contract also calls for the necessary wire-chiefs', monitors' and chief operators' desks, distributing frames, lightning arresters, fire plants, storage battery and complete central office equipment. This is one of the most important contracts, as well as the largest, that has been awarded for some time. The main exchange is to be in operation on September 20 and the subexchanges on October 1, October 15 and November 1, 1903.